JOURNAL *of* FARM ECONOMICS

The American Farm Economic Association and The Canadian Agricultural Economics Society Joint Annual Meeting, August 20-22 Winnipeg, Canada

Proceedings Papers: Joint Meetings of the American Farm Economic Association and other Associations

THE AMERICAN FARM ECONOMIC ASSOCIATION

Volume XL MAY, 1958 Number 2

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Contributed Papers

Price: $9 per year, this issue $2.00

Entered as second class matter at the post office at Menasha, Wis. Acceptance for mailing at a special rate of postage provided for in the Act of February 28, 1925, paragraph 4, section 412, P.L.&R., authorized November 27, 1931. Printed in U.S.A.

THE JOURNAL OF FARM ECONOMICS is published five times a year during February, May, August, November and December by The American Farm Economic Association. Yearly subscriptions $9. Published at Menasha, Wisconsin.

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JOURNAL
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FARM ECONOMICS

Volume XL MAY, 1958 Number 2

AGRICULTURE'S PUBLIC RELATIONS

BUSHROD W. ALLIN*
Agricultural Marketing Service, USDA

YOU and I are economists . . . practitioners in a field embraced within the social sciences. As such, the social culture and general climate of opinion within which we operate are always matters of practical concern, in the technical and professional sense.

It is within that framework that I have chosen to speak tonight on the generalized subject of agriculture's public relations. Obviously, I speak as an agricultural economist, and not as an expert in the public relations field. My basic concern, as you will see, is with the impact of our public relations situation upon economic policy and action in agriculture.

I suggest that we have some major problems or difficulties in this area. Good public relations for any enterprise, I believe, can be achieved only through an accurate and constructive understanding by the public of the activities and problems of that enterprise. The importance of this kind of understanding is especially great for agriculture—in a nation where the vast majority of people are engaged in nonfarm pursuits.

There are a number of important gaps in the needed continuum of understanding between farm and city people. And these gaps positively hamper the efforts of social scientists—economists—to develop useful means of dealing with practical problems of agriculture and farm people.

In industrial public relations—where industrial economists have faced something of the problems we are meeting with—it is axiomatic that an industry which wants good public relations must put its own house in order, as well as tell a pleasing story to the world. And so it is with agriculture. I shall touch upon both of these requirements as we proceed, although my main message is the need for wider public understanding of

* Address presented at dinner meeting, American Farm Economics Association Winter Meeting. The views expressed here are those of the speaker and do not necessarily reflect the views of the Agricultural Marketing Service or of the Department of Agriculture.

the thing we call the "farm problem"—as a necessity for intelligence in policy and action.

I

If I know any fact other than those I can see, hear, smell, taste or touch, it is the fact that Americans are inclined to regard favorably our *free, efficient, individualistic, family farmer* who owns, manages, and does the manual labor on his own farm. Poets and philosophers have sung his praises from our earliest times. And many of our farmers do meet these specifications. But even though in very many instances this affection is bestowed upon real people, it is largely an affection for an abstract ideal inherited from our past when farming was more a way of life than a modern business.

This particular ideal—this romanticized image—has great public appeal, especially to nonfarm people, so much so that the image itself is sometimes a substantive problem in arriving at workable solutions to the real-life problems of farmers.

As an *American* agricultural economist—and wedded to American ideals of freedom—freedom for the farmer is a part of my personal creed. Nevertheless, this essentially urban image of the wholly individualistic farmer—of the frontiersman of another day—is quite often a barrier to better public understanding by the urban majority of the nation of the problems and needs of agriculture. In some respects it is a key problem of agriculture and is itself at the root of the so-called "farm problem."

Individual freedom we *must* have in order to remain the Land of the Free. And individual efficiency we must have in increasing degree or throw away our chances for better living. But freedom alone—or even freedom coupled with efficiency—is not enough to solve the difficulties of an agriculture beset by manifold troubles. I know of no one in a responsible position in agriculture, or even reasonably well-informed about agriculture's current situation who believes for an instant that all farm problems can be dealt with solely through individual action by individuals acting alone.

Instead, agriculture's leadership generally is in agreement upon the need for some measure of curb and limitation upon sheer individualism as a necessity for enlarging the individual's freedom in a complex society. No parking signs, speed limits, and traffic lights have their practical uses in agriculture, as well as in the crowded centers of big cities.

However, I am convinced the urban resident's romantic image of the "bold peasant, his country's pride," is not this complicated—that it envisions the farmer of today as a pure individualist. Imagewise, he is a cross between Robinson Crusoe and Walden Pond.

To create adequate understanding among urban people of the critical nature of the farm problem—and thereby to generate a suitable climate of opinion among the majority of the nation which will permit practical action to solve the problem—is a task both for the agricultural economist and the public information specialist.

Part of the need for both farmers and city people is a clear recognition of the character of the nonfarm environment which embraces seven-eighths of the nation.

Most of the people of urban America—that is the great majority of our people—live and work in groups, in accordance with a variety of group rules. These rules include labor-union regulations, the precepts of professional ethics, the societal modes of corporation-employee conduct, local restrictive ordinances, and even the prescribed norms of the Wednesday afternoon bridge club.

None of these urbanites, as individuals, has the kind of unbridled freedom he imagines for his farmer ideal. Nor is his admiration for it sufficiently strong to induce him to trade his kind of freedom for it.

The city dweller's mental images are his own, of course—and he is welcome to them. But agriculture has a direct concern that the nonfarm majority bring this particular one into conformity with reality as closely as possible. Else it can prove an obstacle to progress, a barrier to needed actions within agriculture.

I see a certain good will in this image—but it is only to the farmer as an idealized *individual*. It does not extend necessarily to his actions in concert with other farmers, especially to those aimed at enhancing his own bargaining power with relation to that of the dealer, the handler, and the consumer. His participation in organizations and programs aimed toward this end encounters a different attitude. This attitude is wholly pragmatic, wholly divorced from nostalgia. When through organizations of his own, or through public programs, he pushes his way into a bargaining position, the public yields to his strength. The response is acceptance or acquiescence in a *fait accompli*—but no more. Of course, when such activities do not work well, the public feels discomfort and duly protests. But the approach is at least practical.

The reason for this contrast of attitudes is obvious. In wholly individualistic operations, the farmer presents no problem involving conflict of interest with buyers of his products since he has no withholding power and therefore must sell at the market price. He can gain this power only when he acts jointly with other producers. And when he does this, conflicts of interest arise promptly since such conflicts are the essence of bargaining.

Basically, there should be no difficulty in making urban people under-

stand the problems involved in this bargaining situation. After all, there are numerous parallels in the city person's own experience with collective bargaining, both in business and in labor.

Not so long ago, Henry Ford was an inventor and manufacturer and an individualist in high degree. He, like the frontier farmer, combined in one person the four economic functions of owner, manager, risk-taker, and laborer. He needed no bargaining power. He was a national hero, like the farmer ideal. His corporation was personified as an *individual*.

But times have changed, and so has this company. Today, with its separation of the functions of ownership, management, and labor it is as different from its ancestor as the Thunderbird is different from the "Tin Lizzie." The firm today has great economic power—though it has shifted far from the individualism of its founder. Actually, it has joined the procession of other large modern corporations which today have the power to exercise "price leadership" and "administer" prices in their own fields.

Each of these corporations values freedom highly, you may be sure. But none of them bases their power on unrestricted individualistic action. They know well what that could do to them—and they want none of it.

This development in corporate management has had its counterpart in the labor field. A half century ago the industrial worker, though he was even then working in his way toward a different setup, was predominantly individualistic.

In those days, the then current "right to work" slogan enjoyed wide support, by the general public as well as by the more orthodox economists. The slogan of that day embodied the belief that the individual worker should be completely free to work for anyone—anywhere—at any wage—and under almost any set of working conditions.

Associated with this concept was a general fondness for the efficient piece-worker, who was extolled as the symbol of American democracy and freedom. And at least a few employers found it useful to say to their other workers, "Look at him. He can make a decent living at these wages. Why can't you?"

I am sure none of us today could embrace these earlier concepts in their then current sweep and magnitude.

Labor, like industry, has managed to meet this issue through organization—has managed to create a group mechanism which has created for its members *bargaining power*. Most protagonists of this development hold, I am sure, that what the worker has sacrificed in individualistic action has been more than offset by an expansion in his economic and social freedom.

Development of an effective labor movement was greatly assisted by the upsurge of public understanding of the practical problems of working people. Also, the techniques of Frederick Taylor and others were slowly

but surely recognized as means for increasing the efficiency of labor. Increased productivity came to be accepted as a basis for greater returns to labor as well as management. And with the passage of time, union membership has become respectable. It is even supported today by a very large segment of corporate employers who evidently recognize it as profitable and economical—as good economics as well as social justice. Economic textbooks now find a place for collective bargaining by labor—though many of them have difficulty squaring this position with the competitive model.

This progress in general economics is due in no small part to the theoretical contributions of such economists as the late John R. Commons. Even Boulding says, "In Commons I would agree that we see the most successful attempt to enlarge the borders of economic abstraction, . . ., he foreshadows much that is happening today in the theory of organization and behavior. . . ." So far as the role of collective bargaining is concerned, agricultural economics is beginning the similar evolution that is increasingly being revealed in general theory as currently expounded by such theorists as Cochrane, Galbraith, Mitchell, Parsons, Wilcox and others. John H. Davis is encouraging its practical application when he talks about the need for "horizontal integration."

Perhaps the growth of the group-action approach in both business and labor has gone too far to suit some of us. But there is no doubt that it has grown remarkably and that its growth is essentally *urban* in character.

Surrounded by Big Business on the one side and by Big Labor on the other, what is the farmer's position in relation to this environment?

Agriculture is not *Big Agriculture*. Organization-wise, it stands rather closely to where industry and labor stood some 50 to 75 years ago.

Agriculture now has three general farm organizations. Each of them has different views concerning policy, though there seems to be growing agreement among them on what the commercial farm problem is—namely, that the American commercial farm plant with its more than two million separate enterprises has an aggregate production capacity and performance *in excess* of the amount that can be sold on the free market at satisfactory prices. Farm leaders are not together on the remedies, and their disagreements do not contribute to a useful understanding of the farm problem by the general public.

Moreover, the highly efficient farmer of today who earns an exceptionally good living because his output is very large and his unit cost unusually small bears an uncomfortable resemblance to some of his forerunners in industry and labor. And the fact that his large production involves heavy additions to the agricultural surplus problem is not unworthy of mention. At the same time, the fact that so many of agriculture's problems center around the low-income farmer, the "shirt-tail" producer, the

part-time farmer, the farmer who is unskilled in farm work and who lacks tools for the job, and all the array of "in-and-outers" of many kinds likewise gives us pause. These things, too, have had their parallels in industry and labor in the past.

I do not know what agriculture's eventual line of march will be as it moves toward solution of these and other problems. I do feel positive that the solution can be found within a framework of *civilized* freedom for farm people, rooted in efficiency of production and marketing.

This is not to say, however, that additional group action may not be necessary, especially in the area of *bargaining power*. I am certain that it will be necessary. After all, agriculture is not wholly an exception to the general case that freedom for all is often best preserved by some limits on the privileges of each.

II

And now a few observations on the score of agricultural efficiency.

For nearly a century, the Department of Agriculture and the Land-Grant Colleges have been working with farmers to improve the efficiency of agricultural production. An enormously successful job has been done in this area—so successful that we are keeping on producing more and more with less and less input of resources—and so have on our hands a first class Grade A problem in marketing our surpluses.

". . . The Indian squaw with stone and bone tools required perhaps 20 hours of woman labor to produce a bushel of corn, the white man with his horse-drawn steel plow and cultivator reduced this within a few decades to two or three hours. Thirty years ago in Iowa it still required half an hour. Today it takes six minutes.

". . . An efficient Iowa farmer can, with the help of one man, grow the corn to produce enough meat and livestock products to feed 300 to 400 people in town."

In the light of these facts, it is plain that efficiency alone, necessary though it is for continued national and agricultural well-being, is far from being a cure-all for the problems of agriculture. No informed person on the agricultural scene would hold that it is such a panacea—any more than he would claim that the savage squaw could equal the civilized farmer's job of producing a bushel of corn in six minutes!

We are today witnessing significant stirrings in agriculture resulting from integration of farming with other phases of agribusiness. The most conspicuous is the development of the broiler industry in recent years. Through the merger of feed-dealer and processor interests with farming operations, financing has been found for achieving economies of scale and increased output that have slashed production costs and prices. The farmer in this process has surrendered some of his decision-making re-

sponsibility, without any evidence at this time that he has improved his long-run economic position. Even though he may prefer the stability of this arrangement, he has not the kind of "freedom" he had in earlier days when he was also manager and risk-taker. Under this new integration, the consumer of broilers never had it so good, and he is probably aware of his good fortune only when he looks at the great supply of chicken meat on his table. Finally, this vertical integration of the industry raises questions as to whether the farmers have enough to say about their share of the total returns to the industry.

Despite the plethora of statements from the Department of Agriculture concerning the "technological revolution" in agriculture (to which I have contributed my share), the idea persists that the only farmer who is not "doing very well indeed" is the inefficient farmer. In general, there is rather too much reliance put on the thought that a complete solution for the farm surplus problem is to move the inefficient farmer to town. This uncomplicated view persists despite the fact that in the last 15 years 30 per cent of our farm population has already moved to town, and that even after this transfer half of our remaining farmers still account for only about 7 per cent of the total marketed farm product.

Although migration out of agriculture is actually taking place on a large scale and the average level of farm efficiency is rising, the surplus problem persists and we continue to achieve record high levels of total output. Perhaps the surplus might disappear if sufficient pressure were applied or if adequate inducements were offered to eliminate several million additional farmers. But I know of no acceptable method for doing this. Is it inconceivable, anti-social, or uneconomic that most of the two million full-time commercial farmers who produce the bulk of the marketed farm product might, through exercising greater bargaining power, stay on their farms, get an income more commensurate with their functions as managers, owners, and entrepreneurs of sizable business enterprises, and thereby retain for themselves a larger share of the benefits that flow from their increased efficiency?

III

As Chairman of the Outlook and Situation Board of the Department of Agriculture, I am regularly called upon to discuss the agricultural situation and outlook, which inescapably involves, in some degree at least, questions on policy and programs. In many instances, these discussions are with nonfarm groups of well-educated and well-trained people. Among the nonfarm groups, as a rule, only a small minority ever had any actual experience with a farm or the farm programs. They are mostly business and professional people. From their questions and comments, I conclude that a large majority of the American people know very little about the

problems of the farmer and little about his contributions to their welfare.

Throughout the 36 years I have been a professional agricultural economist, the controversial subject of federal farm price policy and programs has been a central point of interest in the profession. With respect to this subject, I now have two convictions concerning the performance of the profession as a whole: (1) We have made great progress in dealing with technical aspects of the issues involved; (2) we have been something less than effective in conveying to the public some simple, key facts about these issues.

Now what are some of these facts?

Urban people, I believe, do not understand that the producers of wheat and cotton could give their entire crops free of charge to the American public without having more than a minor effect on the retail prices of products made from these raw materials. They do not know that a 20 cent loaf of bread represents only about 2½ cents worth of wheat. They do not know that a $4 cotton shirt contains less than 25 cents worth of cotton. They do not know that the price the farmer receives or the raw material cost in these wheat and cotton products represents only one-eighth of the retail price of bread and less than one-sixteenth of the retail price of shirts.

The American consumer does not understand that an indeterminate but substantial portion of all agricultural exports to friendly countries since World War II would have been purchased at U. S. government expense for such purpose even if there had been no surplus disposal problems.

Since many labor union contracts with leading industrial corporations contain escalator clauses hooked to the Bureau of Labor Statistics cost-of-living index, the public watches this index closely and is especially alert for changes in food costs. The urban consumer seems to be unaware of the fact that when the "food" component of this index changes it may or may not have any relation whatever to changes in farm prices. He tends to think of "food" as nutrients rather than the "services" connected with the nutrients—services the prices of which can and usually do change without any relation to changes in farm prices of the raw materials in food.

Urban audiences are quite aware of the rising cost of living, but when I tell them that the price of a fixed quantity of representative groceries they buy at the grocery store is actually no higher than the peak level reached in August 1952, they look at me with an expression that seems to say, "Either you or somebody else is mistaken."

Nor do they understand that the relative stability of food prices in the past five years is due to the fact that farm prices (the prices of the raw material at the farm) have declined during the period by 18 per cent while marketing costs (costs of services) of food have increased by 10 per cent, and that the farmer's share of this relatively stable food dollar

has declined from 47 to 40 cents. They are entirely oblivious to the fact that the only reason the percentage of their disposable income they spend for food remains stable is that the percentage they spend for the raw material in food has declined enough to offset the rise in the percentage they spend for the services connected therewith—services that have nothing whatever to do with farm prices.

What is more, urban consumers are seldom aware that in 1956 the wages for an average hour of industrial labor bought (even at retail prices and including all the services) 38 per cent more bread than in 1939, 22 per cent more beef steak, 58 per cent more fresh delivered milk, 42 per cent more butter, 75 per cent more bacon, 65 per cent more eggs, 13 per cent more potatoes, and 55 per cent more oranges.

Facts like these constitute by no means an exhaustive list of the things nonfarm people should understand if they are to have a balanced view of the farm problem. They are only illustrative. They are released regularly by analysts in the Department of Agriculture and other government agencies, and are available to anyone who wishes to use them. Still, intelligent people rise regularly in urban audiences and ask if it isn't true that most commercial farmers are driving Cadillacs. Others appear to believe that during the Texas floods farmers rowed their boats to the relief office to collect their drought checks.

To sum up: I have said that the romanticized ideal of the free and efficient individual farmer is held in high esteem by American public opinion. But in my judgment this romantic ideal, appropriate for an earlier age, is now serving to confuse and divide our farmers as they attempt to achieve equality of bargaining power in our highly organized economic society. Though the farmer has achieved notable successes in this field of activity, the present situation is most difficult. All the available choices for action are difficult from some point of view: the present programs are not working well and the public does not like their relatively high costs, to say nothing of other more costly ones. Yet farmers are most unhappy at the prospective incomes that would flow from completely free prices. Confronted with this dilemma, the first requirement is unity of purpose and method among farm leaders. Only under such conditions can the simple facts of the *case for* farm programs be adequately presented to an interested public and only then can agriculture's public relations have a chance of being adequate.

REGIONAL PATTERNS OF TECHNOLOGICAL CHANGE IN AMERICAN AGRICULTURE*

THOMAS T. STOUT AND VERNON W. RUTTAN**
Purdue University

THIS paper represents a second progress report[1] on a study of "Technological Change in American Agriculture" which is currently being conducted at the Purdue Agricultural Experiment Station.

The objectives of this project, as outlined in the project statement, are:

1. ". . . to measure the differential impact of technological change on farm output in the major agricultural regions of the United States. . . .
2. ". . . to assess the relative importance of a number of major innovations or classes of innovations . . . and to analyze the differential regional impact of these innovations.
3. ". . . to investigate the relative importance of a number of strategic technical and economic factors which have resulted in the differential impact of technological progress on agriculture in the several regions.
4. ". . . to project the impact of alternative patterns of technological change on future farm output and agricultural resource requirements in the several regions of the nation."

The progress of this project implies two types of disaggregation—first to the regional level, and second by types of innovation. This pattern of investigation can be contrasted to two approaches that have been used at the U. S. Department of Agriculture. Sherman Johnson and Harold Breimyer have investigated the sources of increasing farm output by examining the effect of specific innovations or patterns of substitution on output at the national level.[2] The Farm Economics Research Division (ARS, USDA) has investigated the impact of technology on commercial farms in specific type-of-farming areas, but has made no attempt to construct regional or national aggregates on the basis of this work.[3]

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* Purdue Agricultural Experiment Station Journal Paper #1214, Project 917. This project is financed by grants from the National Science Foundation and Resources for the Future.

** The authors would like to express their appreciation to Glen T. Barton, F. L. Garlock, J. A. Munger, W. H. Scofield and R. W. Hecht of the Agricultural Research Service, USDA, and to R. H. Masucci and Q. F. Dallavalle of the Agricultural Marketing Service, USDA, for their assistance in assembling data used in this study.

[1] For the first progress report on this project, see Vernon W. Ruttan, "Agricultural and Nonagricultural Changes in Output Per Unit of Input," *Journal of Farm Economics*, 39 (December, 1957), pp. 1566-1576.

[2] Harold F. Breimyer, "Sources of Our Increasing Food Supply," *Journal of Farm Economics*, 36 (May, 1954), pp. 228-242, and Sherman E. Johnson, *Changes in American Farming*, USDA, Misc. Pub. 707, December 1949. Ray Bressler uses a somewhat similar approach in "Farm Technology and the Race with Population," *Journal of Farm Economics*, 39 (November, 1957), pp. 849-864.

[3] *Changes in Farm Production and Efficiency*, ARS 43-45, Agricultural Research Service, USDA, Washington, D.C., June 1957.

In this paper we consider part of the results obtained in the first phase—the measurement phase—of the project. Before proceeding to a discussion of the results of the regional comparisons, we identify some of the methodological problems involved in the measurement of technological change.

Output per Unit of Input as a Measure of Technological Change

The major conceptual difficulty involved in measuring the contribution of technological change to output centers around the problem of separating the impact of technology from other changes which result in increases in either total or per capita output.

Technological change can be broadly defined as a change in the parameters of a production function resulting directly from the use of new knowledge. This includes both "neutral" shifts and changes in the "slope" of the production function.[4] It has become increasingly popular in recent years to interpret changes in output per unit of total input between two periods as a measure of technological change.[5] This is the approach employed in our study.

There are, however, a number of circumstances other than technological change which can give rise to changes in output per unit of total input between two periods. These include:

1. *Changes in the degree to which input or output combinations differ from the equilibrium combinations.* Even in the absence of technological change, a shift toward the equilibrium combination will result in a rise in output per unit of input while a shift away from the equilibrium combination will result in a decline in output per unit of input.

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[4] See for example Solow's discussion on "Technical Change and the Aggregate Production Function," *The Review of Economics and Statistics,* 39 (August, 1957), pp. 312, 313. Also, Vernon W. Ruttan, "The Contribution of Technological Change to Farm Output, 1950-75," *The Review of Economics and Statistics,* 38 (February 1956), pp. 61, 62.

[5] See for example M. A. Copeland, E. M. Martin, "The Correction of Wealth and Income Estimates for Price Changes," *Conference on Research in National Income and Wealth,* Vol. II, New York, 1938, p. 127; George J. Stigler, *Trends in Output and Employment,* New York, 1947, pp. 43-45; Barton and Cooper, "The Changing Efficiency of the American Economy," *Review of Economics and Statistics.* 34, (August, 1952), pp. 214-32; T. W. Schultz, *The Economic Organization of Agriculture,* McGraw-Hill, New York, 1953, pp. 99-124; Vernon W. Ruttan, *Technological Progress in the Meat Packing Industry, 1919-47,* USDA Marketing Research Report #59, January 1954; John W. Kendrick, *Productivity Trends, Capital and Labor,* Occasional Paper 53, National Bureau of Economic Research, Inc., 1956, p. 14; T. W. Schultz, "Reflections on Agricultural Production, Output and Supply," *Journal of Farm Economics,* 38. (August, 1956), pp. 756-760; Moses Abramovitz, *Resource and Output Trends in the United States Since 1870.* Occasional Paper 52, National Bureau of Economic Research, 1956, pp. 12, 13; Ruttan (1956), *op. cit.*

2. *The existence of either increasing or decreasing returns to scale.* As output rises increasing returns to scale will result in a rise in output per unit of input, while decreasing returns to scale will result in a decline in output per unit of input.

There are indications that the limitations imposed by these two circumstances may not be overly restrictive in the present study. There is strong evidence that in agriculture comparison of changes in output per unit of total input between the mid 1920's and the late 1940's does not result in any substantial bias resulting from violation of the equilibrium condition.[6] And production economics research is providing growing evidence that agriculture is characterized by approximately constant returns to scale.[7]

Even if the equilibrium and scale conditions are met, two other conditions must be satisfied if change in output per unit of input between two periods is to provide an unbiased measure of technological change.

1. *Prices of factors must remain unchanged relative to each other, and prices of products must remain unchanged relative to each other.*[8] When these price conditions are not met, the use of beginning period (Laspeyre) weights to combine inputs and outputs into measures of total input and total output results in a downward bias in the index of output per unit of input. With end period (Paasche) weights the effect is to bias upward the index of output per unit of input.

While prices of the major farm products have remained reasonably stable relative to each other, prices of inputs used in agricultural production have not.[9] In this study we have attempted to "bracket" the bias in the index of output per unit of input resulting from shifting input prices by employing both beginning period (Laspeyre) and end period (Paasche) weights for fairly short (five to 15 year) periods. Link relative indexes were employed to combine the sub period indexes into indexes of input, output, and output per unit of total input for the entire 1925-55 period.

2. Beginning period (Laspeyre) and end period (Paasche) weights effectively "bracket" the range within which the measure of technological

[6] See for example Ralph A. Loomis, "Effect of Weight Period Selection on Measurement of Agricultural Production Inputs," *Agricultural Economics Research*, 9 (October, 1957), pp. 129-135.

[7] See for example E. O. Heady and Russell Shaw, "Resource Returns and Productivity Coefficients in Selected Farming Areas," *Journal of Farm Economics* 36 (May, 1954), pp. 243-257.

[8] For a discussion of the index number problem in relation to the problem of measuring technological change see George W. Ladd, "Biases in Certain Production Indexes," *Journal of Farm Economics*, Vol. 39 (February, 1957), pp. 75-85; Ruttan, *op. cit.*, (1954), pp. 15-20.

[9] See for example "Agricultural Prices and Parity," Volume 1 in *Major Statistical Series of the United States Department of Agriculture*, USDA, Agricultural Handbook #118, August, 1957.

change must fall only if an additional condition holds—*technological change must be "neutral."*[10] Shifts in the production function are "neutral" if they leave the productivity coefficients unchanged and simply increase or decrease the output attainable from given inputs. When technological change is nonneutral no single indicator, such as the change in output per unit of input, can adequately serve as a measure of technological change. The increase in output per unit of input actually obtained from a given nonneutral change in the production function will depend upon the specific input combination and factor prices prevailing at the time the change is introduced.

There is a substantial basis for believing that technological change in American agriculture has not been neutral over the 1925-55 period. While the extent of nonneutrality is difficult to evaluate, it seems quite unlikely that the very rapid declines in farm employment over the period can be accounted for entirely by an increase in the price of labor relative to other inputs.

In addition to the equilibrium, scale, price and "neutrality" conditions, two problems of definition and measurement must be considered when output per unit of total input is employed as a measure of technological change.

1. *Both output and input must be measured "net" of current operating expenses.*[11] Output thus represents the "value added" to national output, and input represents the primary factors—labor and capital (including land and buildings)—contributed by the particular firm or industry being studied. The purpose of using "net" measures of output and input is to eliminate double counting of inputs and outputs. The weighted average of the rates of change in output per unit of input achieved by individual regions or industries will then equal the rate of change achieved by the industry or the economy as a whole. When interindustry or interregional comparisons are not the objective, there may be some point in using input-output ratios based on both "net" and "gross" measures to gain, for example, a better understanding of the role of current inputs (supplies and operating expenses) in the growth of total "gross" output.

2. *Inputs should be aggregated geometrically rather than arithmeti-*

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[10] Solow, *op. cit.*, pp. 316-319; Ruttan, *op. cit.*, (1954), pp. 15-20. Gregg Lewis has pointed in a letter, that the test for neutrality proposed by Solow is in error. Examples can be found which meet his neutrality test and yet involve nonneutral change. Examples can also be found which involve neutral change, but which do not meet the neutrality test proposed by Solow.

[11] Kenneth May, "Technological Change and Aggregation," *Econometrica,* Vol. 15, (January, 1957), pp. 51-63; Ruttan, *op. cit.*, (1954); John W. Kendrick, *op. cit.*, pp. 3-6; T. W. Schultz has suggested, in a letter, that what one considers as "value added" to purchased inputs will vary depending on both the nature of the economic unit and the time period under consideration.

cally.[12] Arithmetic aggregation is equivalent to the choice of a linear production function. Geometric aggregation is equivalent to the choice of a Cobb-Douglas type production function. Furthermore, the exponential form of the Cobb-Douglas equation permits the marginal productivity of individual inputs to vary without violating the assumption of neutral innovation. Use of an arithmetically linear function involves the assumption that changes in the marginal productivities of the several factors can occur only as a result of technological change.

Interregional Comparisons of Technological Change

Our initial interest in developing regional comparisons of change in output per unit of total input, rather than proceeding directly to a study of the impact of specific innovations, stemmed from a concern with the implications for agricultural policy if a major share of the total resources savings due to technological change over the period, 1925-55, were concentrated in one or a few regions.

The results of our regional comparisons of change in net output per unit of total net input are presented in summary form in Table 1 and in Figures A-F. The input and output per unit of total input indexes in Table 1 represent both Laspeyre and Paasche link relative indexes for the periods 1925-27 to 1938-40; 1938-40 to 1948-50; and 1948-50 to 1953-55. The indexes of total net inputs employed in the comparisons in Figures A-F are Laspeyre indexes based on 1925-27 only. As a result the input-output indexes presented in the charts will tend to fall somewhat below the input-output indexes presented in Table 1 during the later years. The indexes in Table 1 provide the best basis for long period comparisons. The charts present the best basis for short period or year-to-year comparisons.

We would like to center our discussion of the empirical results of the regional comparisons around two hypotheses.

On the basis of casual observation of changes in output and income *it seemed reasonable to hypothesize that a major share of the resource savings resulting from technological change would be concentrated in two regions, the North Central and the Pacific, and that the Southern region would experience the greatest lag in technological change.*

Examination of Tables 1 and 2 indicates that this hypothesis is only partially correct. The North Central and Pacific regions together accounted for between 55 and 60 per cent of the total resource savings resulting from technological change in American agriculture between 1925 and 1955.

The pattern of change was, however, somewhat different than expected.

[12] See Zvi Griliches, "Specification Bias in Estimates of Production Functions," *Journal of Farm Economics*, 39, (February, 1957), pp. 8-20; Ruttan, *op. cit.*, (1956), pp. 61-69; Solow, *op. cit.*, pp. 317-319.

TABLE 1. INDEXES OF TOTAL NET INPUT, TOTAL NET OUTPUT AND OUTPUT PER UNIT OF INPUT IN AGRICULTURE FOR THE UNITED STATES AND FIVE MAJOR REGIONS, 1925–27 TO 1953–55

	United States	Northeast	North Central	South	Mountain	Pacific
Net Output						
1925–27	100	100	100	100	100	100
1938–40	113	108	111	113	110	130
1948–50	128	102	131	121	139	160
1953–55	130	104	127	122	145	190
Net Inputs—Laspeyre Weights						
1925–27	100	100	100	100	100	100
1938–40	93	88	93	91	98	103
1948–50	87	75	86	83	98	107
1953–55	83	71	83	78	101	111
Net Inputs—Paasche Weights						
1925–27	100	100	100	100	100	100
1938–40	92	88	91	91	95	106
1948–50	84	73	81	83	93	107
1953–55	83	71	80	81	100	111
Output Per Unit of Input—Laspeyre Basis						
1925–27	100	100	100	100	100	100
1938–40	121	123	119	124	113	126
1948–50	146	137	151	145	142	149
1953–55	155	147	153	155	145	177
Output Per Unit of Input—Paasche Basis						
1925–27	100	100	100	100	100	100
1938–40	123	123	122	125	116	124
1948–50	153	139	161	148	150	150
1953–55	159	147	158	154	149	177

Source: An appendix on the data and their sources is available from the authors.

Only in the Pacific region was the rate of increase in both net output and output per unit of input sufficiently rapid to permit the regions share of resource savings to differ sharply from its share of output (Table 2). With only 7.7 per cent of the nation's net farm output in 1925-27, and 11.7 per cent in 1953-55, the Pacific region accounted for between 14.3 (Laspeyre weights) and 20.7 (Paasche weights) per cent of the nation's total agri-

TABLE 2. RELATIVE IMPORTANCE OF REGIONAL RESOURCES SAVINGS DUE TO TECHNOLOGICAL CHANGE, 1925–55

Region	Per Cent of Net Output in Current Dollars		Per Cent of Resource Savings Resulting from Technological Change	
	1925–27	1953–55	1925–27 weights	1953–55. weights
Northeast	9.7	7.8	6.9	5.3
North Central	42.3	41.5	40.3	40.5
South	34.7	32.5	33.0	27.6
Mountain	5.7	6.5	5.4	5.9
Pacific	7.7	11.7	14.3	20.7
United States	100.0	100.0	100.0	100.0

Source: An appendix on the data and their sources is available from the authors.

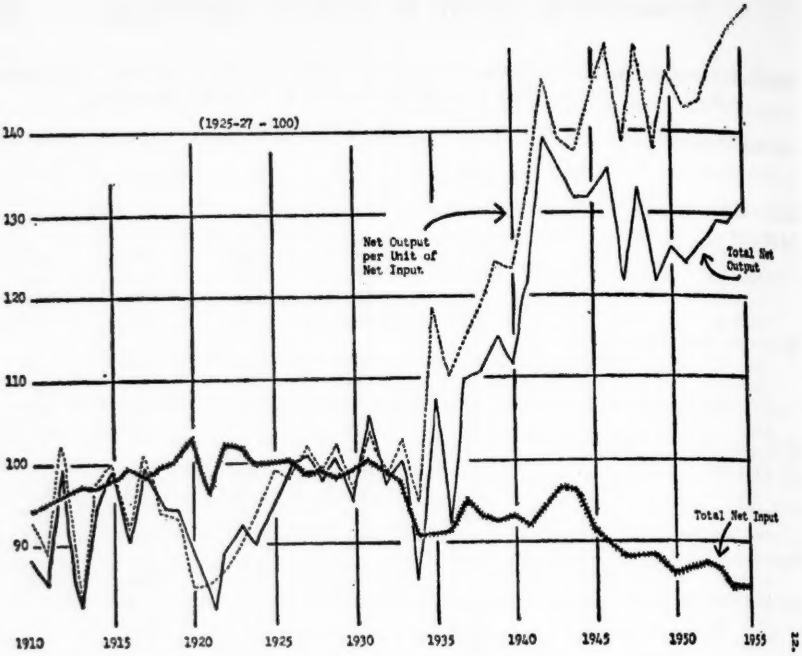

FIG. A. Indexes of Total Net Output. Total Net Input and Output per Unit of Input in Agriculture, United States, 1910-55.

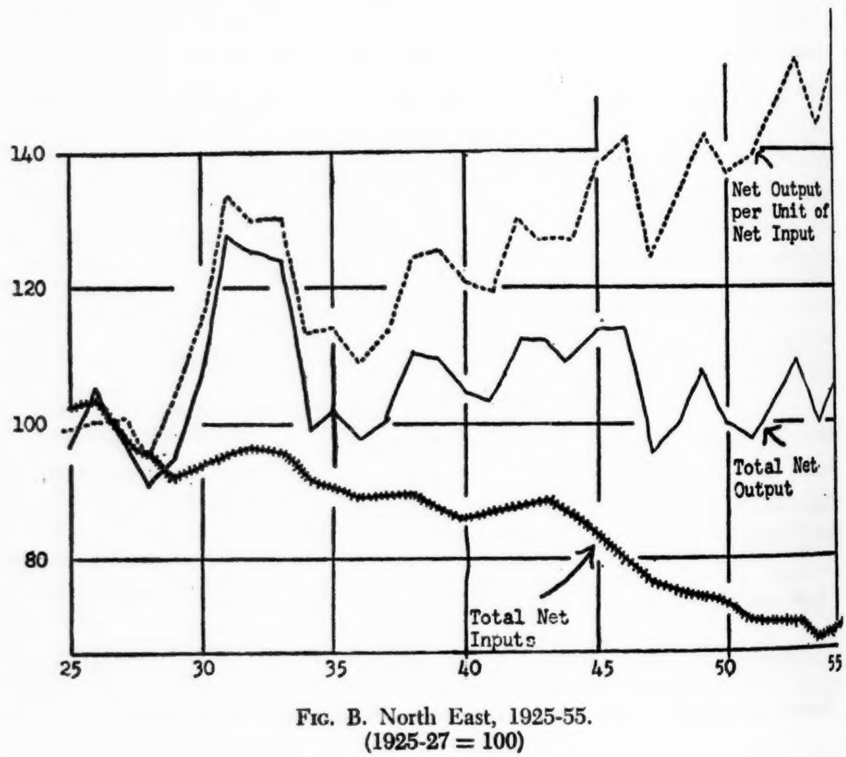

FIG. B. North East, 1925-55.
(1925-27 = 100)

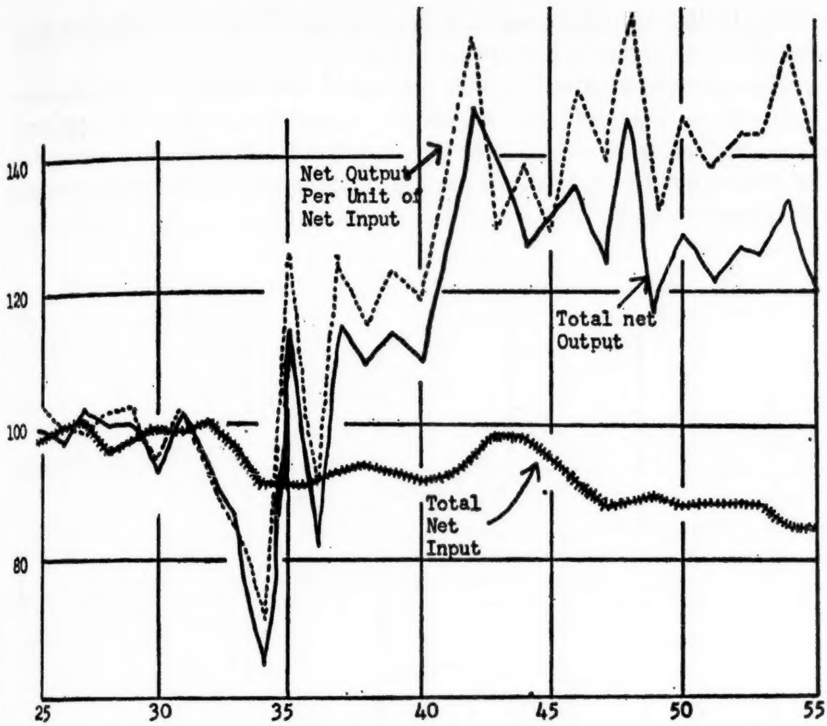

FIG. C. North Central, 1925-55.
(1925-27 = 100)

cultural resource savings due to technological change between 1925 and 1955.

The North Central region did not depart sharply from the national average in either growth of net output or in output per unit of input. The region accounted for approximately 42 per cent of the nation's net farm output in both 1925-27 and 1953-55 and between 40 and 41 per cent of the nation's total agricultural resource savings resulting from technological change between 1925 and 1955.

Approximately identical rates of technological change were observed in both the South and the North Central region. However, the proportion of the nation's resource savings which occurred in the South fell somewhat below the South's share of net output as net output in the South failed to keep pace with the national average—falling from approximately 34.7 per cent of the total in 1925-27 to 32.5 per cent in 1953-55.

The smallest increases in output per unit of total input occurred in the Northeast and in the Mountain region. In the Northeast this appears to have been primarily associated with a decline in output relative to other

areas. In the Mountain region output increased fairly rapidly but inputs failed to decline as in most other regions.

The second hypothesis which we would like to examine is Cochrane's thesis that: "*It is probably not correct to visualize individual supply relations drifting to the right over the past several decades at an even pace. In the aggregate at least, the supply relation has expanded in a hopping or skipping action.*"[13]

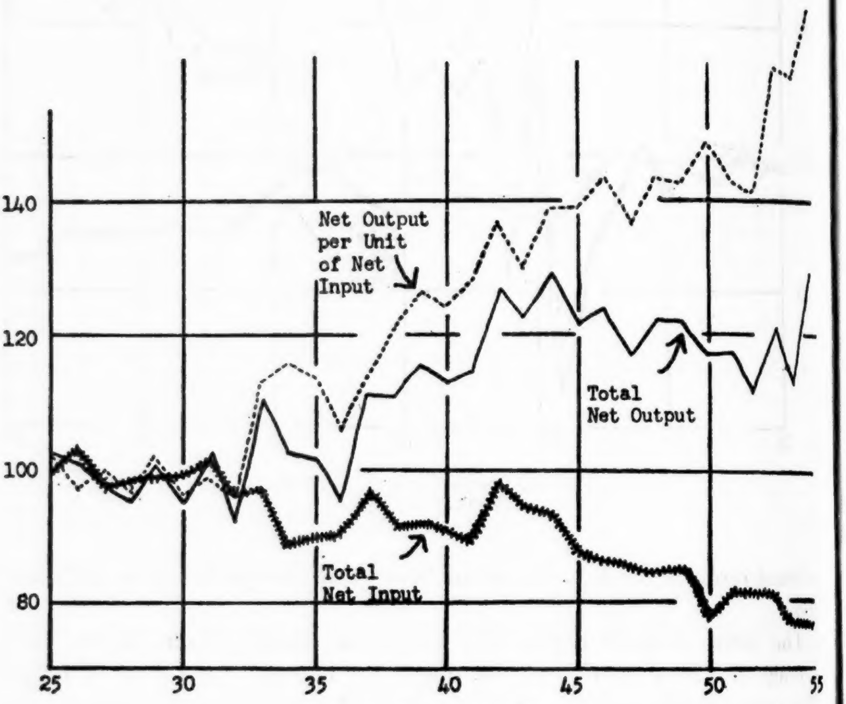

FIG. D. South, 1925-55.
(1925-27 = 100)

Cochrane's thesis was based upon examination of changes in output per unit of input at the national level. Between 1910 and 1919 net output per unit of total net input shifted sharply up and down with an average index of about 95 (1925-27 = 100). Following a sharp decline during the agricultural depression of the early 1920's the index remained somewhere near 100 during the 1925-35 decade. This was followed by a spectacular rise in output per unit of input in the late 30's and 40's and by a new plateau at an index of about 145 extending from 1943 to 1951. Since 1951

[13] Willard W. Cochrane, "Conceptualizing The Supply Relation in Agriculture," *Journal of Farm Economics*, 37, (December, 1955), pp. 1161-1176.

output per unit of input has risen steadily, standing at an index of 155 in 1955.

If a similar pattern were observed in each of the major agricultural regions, the Cochrane hypothesis would be considerably strengthened.

The data on Figures A-F only partially support the Cochrane hypothesis. In the North Central and Mountain regions output per unit of input experienced little or no gain during the 1925-35 decade. This was followed

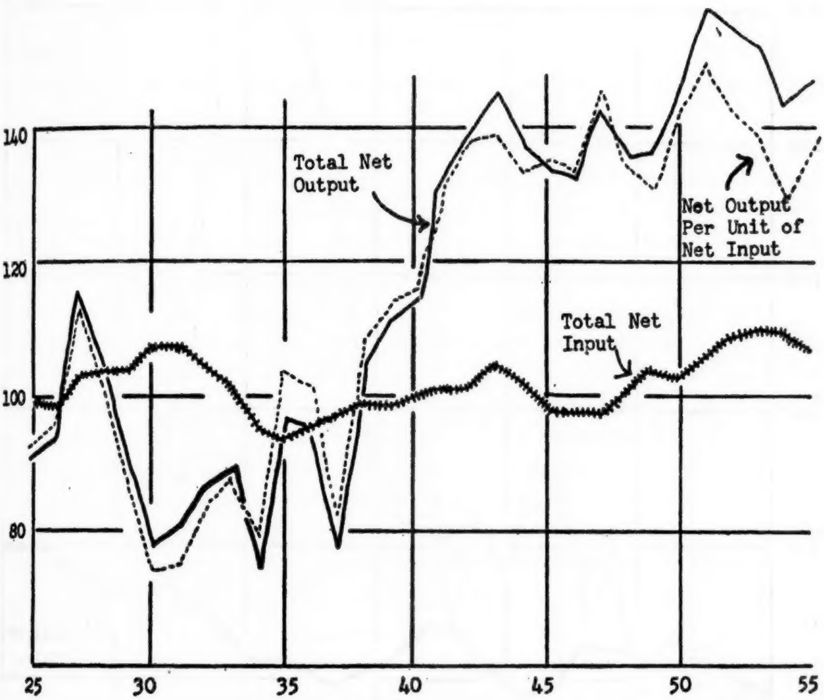

FIG. E. Mountain, 1925-55.
(1925-27 = 100)

by a period of spectacular expansion in the output-input ratio during the late 30's and early 40's and by a second period, extending from 1942 to the present, during which output per unit of total input remained virtually unchanged.

In constrast to the North Central and Mountain regions where the time sequence of technological change has been consistent with Cochrane's thesis, output per unit of input in both the Northeast and Southern regions has expanded at a rather steady rate throughout almost the entire period. The contrast is especially striking in the period since 1942. Since 1942, output per unit of input has pushed steadily upward in the

Northeast and in the South, while experiencing almost no gain in the North Central and Mountain regions. In both the Northeast and the South the increase in the output-input index is associated with fairly rapid declines in total inputs rather than with increases in net output.

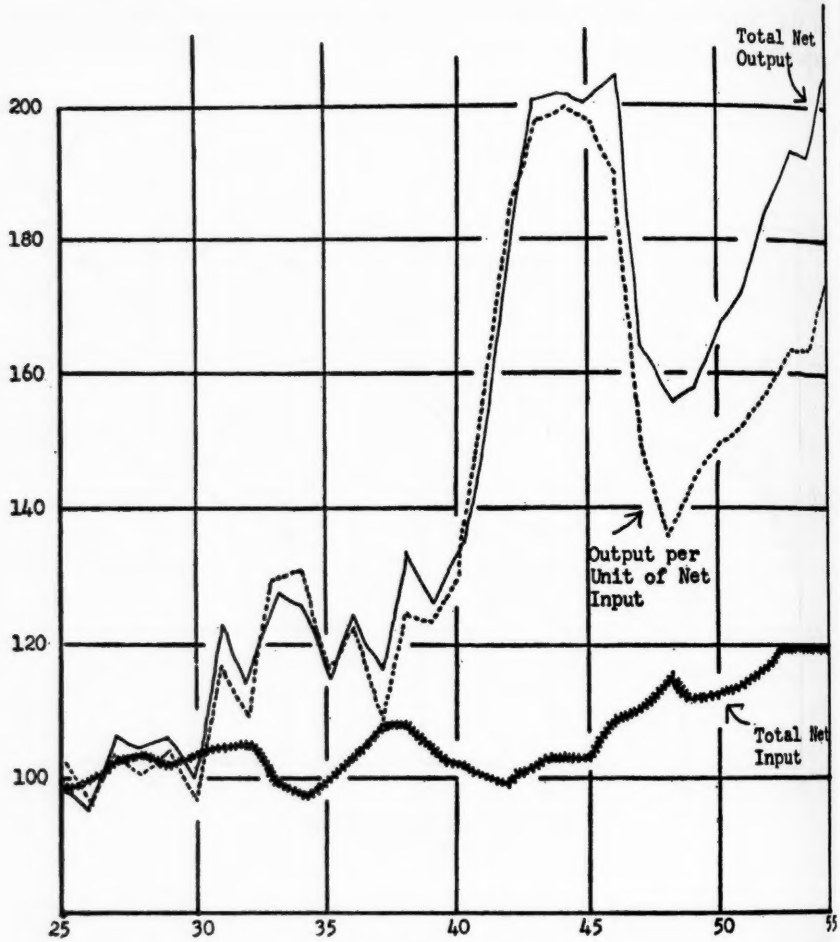

FIG. F. Pacific, 1925-55.
(1925-27 = 100)

In the Pacific region the time sequence of technological change, measured by the output-input index, combines elements of both patterns discussed above. The output-input index moved steadily upward from 1925 to 1940. This was followed by an extremely rapid growth in output per unit of input between 1940 and 1943; a short plateau with an index of slightly below 200 from 1943 to 1945; a drop to below 140 between

1945 and 1948; and a rapid rise between 1945 and 1955. The very sharp decline in both net output and output per unit of input between 1945 and 1948 is difficult to explain in view of the relative stability in both the index of "gross output" and of "net inputs" during this period. The necessity of using a national rather than a regional price index to deflate a current value estimates of "net input" may be one of the factors involved. Additional checking will be necessary before drawing many conclusions from the material presented in Figure F.

Summary

We can summarize our comments with respect to the two hypotheses discussed in the previous section as follows:

1. Technological change has occurred at quite similar rates over the 1925-55 period in both the North Central and the Southern regions—the two regions which together account for almost 75 per cent of the nation's net farm output. Technological change has shown some tendency to lag in the two regions producing the smallest share of net output—the Northeast and Mountain regions. By far the most rapid rate of technological change has occurred in the Pacific region. On the basis of the over-all 1925-55 trend, our initial concern with the possibility of serious interregional lags in the application of new technology does not appear to be warranted. On the other hand, the slow rate of technological change observed since the mid 1940's in both the North Central and the Mountain region may become cause for concern in the future.

2. The Cochrane hypothesis appears to be no more consistent with the year-to-year changes in the pattern of technological change at the regional level than the hypothesis that there has been a steady increase in the contribution of technological change to output over the period since 1925. Only in the North Central and Mountain regions is the time sequence of change consistent with the pattern described by Cochrane. In the Northeast and the South the time sequence is consistent with a steady growth pattern. In the Pacific region neither hypothesis is clearly adequate.

BETTER BASIC DATA FOR AGRICULTURE: SOME POSSIBLE APPROACHES*

M. R. Benedict and G. M. Kuznets
University of California

Though the title of this paper may imply something of the kind, it is not intended as a blueprint for some ideal plan of data collection for agriculture. Its purpose is rather to bring under wider review some of the problems that are currently under study in the Bureau of the Census and the Department of Agriculture. A principal reason for attempting to bring these into sharper focus at this time is that decisions must be made during the next year or two which may affect some features of the data-gathering program throughout the decade of the 1960's. The issues involved should be widely understood and discussed not only by the special committees concerned but by the many types of users whose interests are affected.

The emergence of these problems is not a result of any decline in the quality of output or performance of the data-gathering agencies. It is due rather to the rapid growth in the demands made on them and the growing need for increased accuracy, quicker release and more comprehensive coverage. The demands on the suppliers of basic agricultural data have grown enormously during the past three and a half decades. There has been, in the first place, a very great expansion in the amount of governmental activity relating to agriculture, which has created needs that were nonexistent only a few decades ago. In addition, a vastly larger and far more complex program of research has come into being, accompanied by increased efforts to disseminate economic information to farmers and the general public. Thus, the data supplied must now provide information for administrators, businessmen, researchers and extension people on a scale not easily visualized by those not in close touch with the whole broad range of uses made of the products of the statistical agencies.

During recent years very marked advances have been made in the quality and amount of service provided by the Department of Agriculture and by the Bureau of the Census. These are largely common knowledge and have been presented to this audience in numerous comprehensive summaries.[1] Suffice it to say that the great expansion in data collection that

* Giannini Foundation Paper No. 166.

[1] See, for example, *The Crop Reporting Service of the United States Department of Agriculture,* by W. F. Callander, U.S.B.A.E. (Mimeo.), 1927; *The Crop and Livestock Reporting Service of the United States,* U.S.D.A. Miscellaneous Publication No. 171, November, 1933; "Developments in Crop and Livestock Reporting Since 1920," by Joseph A. Becker and C. L. Harlan, *Journal of Farm Economics,* November 1939; "Development of Agricultural Statistics in the Bureau of the Census," by M. R. Benedict, *ibid.;* and other articles in the November, 1939, special issue of the

got under way in the Department of Agriculture around 1920 has been continued and elaborated in the years since. In the Bureau of the Census, there has been, during the past 20 years, a pronounced shift from rather routine enumerative procedures to a highly professional approach to the many problems of improving, speeding up and expanding the data assembled by that agency.

The problems of current concern in the two agencies differ somewhat, but there is a broad field of mutual interest which is the phase principally under consideration here. In the period from 1900 to the 1920's, a primary purpose of what is now the Agricultural Estimates Division of the Agricultural Marketing Service was to provide accurate and timely estimates of production conditions and prospects to be used mainly as a basis for trading operations.[2] The making of such estimates is still a very important feature of the Department of Agriculture program. It has in fact come into even greater prominence since these estimates are now used extensively in shaping government policy and deciding on current program activities. For these purposes dependable estimates of national totals, made available quickly and at frequent intervals, are of prime importance.

But the demand for many other types of basic data grew enormously as economic problems came to the fore in the 1920's and after, and as staffs capable of assembling and analyzing data of that kind were developed, both in the Department of Agriculture and outside of it. Series relating to price movements and relationships, mortgage debt, taxes, transportation costs, living and production expenses and so on were developed, partly through the facilities of the Division of Crop and Livestock Estimates and partly in other sections of what was then the Bureau of Agricultural Economics. These have come to be used very extensively in the analytical work of the Department of Agriculture and in a vast array of private commercial activities, governmental operations and legislative deliberations.

Along with this, there has been a rapidly growing emphasis on geographic detail, frequency of enumeration or estimate, and broader coverage. Small-area data became especially important in the 1930's and after as it became necessary to make acreage allotments and to base programs and government payments on them. At the same time, business concerns engaged in selling to farmers came to use county and state breakdowns more and more extensively in establishing sales quotas and analyzing

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Journal of Farm Economics. See, also, the later symposium, *The Agricultural Estimating and Reporting Services of the United States Department of Agriculture*, U.S.D.A. Miscellaneous Publication No. 703, December, 1949, and many others too numerous for mention here.

[2] The making of monthly reports was begun much earlier, but a more fully developed organization with full-time state statisticians did not emerge until 1912-1914.

markets. The growing reliance of farmers on purchased production resources has, of course, increased that emphasis. One aspect of it has been a growing interest in such data on the part of the agricultural journals, as a means of strengthening their work in market analysis and aiding in the solicitation of advertising. This shift has created a somewhat new dimension in the business interest in agricultural data.

The earlier concern of business firms, as buyers of farm products, was largely with the accuracy and timeliness of estimates over-all totals, without much regard for geographic detail. That interest still is very important, but the demand for additional, more frequent and more accurate geographic detail has been superimposed on it. A further complication arises from the fact that many business firms, and others as well, want information about new developments in agricultural production and marketing, and in social relationships, which have not been covered at all in the traditional data-collecting activities.

The great strides made in recent years in the field of sampling and sample design have led naturally to exploration, both in the Department of Agriculture and in the Bureau of the Census, of the possibility of greater reliance on sampling as a means of increasing coverage, speeding up release and lowering costs. The use of sampling techniques is, of course, traditional in the Department of Agriculture, and much of the progress made in that type of statistical activity stems from the early efforts of the Department to provide quick, reliable estimates on a wide range of subject matter. From about 1940 on, the Bureau of the Census has also shifted to much more extensive use of sampling techniques. Here, the approach has been along broader and more general lines with superb facilities (perhaps the best in the world) for testing sample design against total universes, concentrating on sampling theory and making field tests.

In this process something of the older basis for division of labor between the two agencies has become less clear and less easily adjusted. Until about 1940, the procedures used in the Bureau of the Census were almost wholly enumerative, those of the Department of Agriculture almost wholly of the sampling type. They supplemented each other without important areas of overlap. The more recent developments in both agencies, and in the realm of statistical needs and methodology generally, make it important to develop a well-integrated joint program which will take full account of economic and political realities and will provide agriculture and the public with the best possible service within the limits of the funds made available.

Developments in Agricultural Estimates

The Division of Agricultural Estimates of the U. S. Department of Agriculture is probably the world's largest supplier of agricultural sta-

tistics. Its current coverage of more than 150 agricultural products requiring some 500 reports per year is larger than that of any other reporting agency. This vast array of basic information has been produced year after year on modest, if not actually meager, direct operating outlays.

It is fair to say, however, that the statistical output of the Agricultural Estimates Division, vast though it is, is subject to some basic limitations, recognized both inside and outside of the Division,[3] which arise from lack of objectivity in sampling and measurement. Many of the primary data which serve as the basis for published estimates are obtained by mail inquiry without direct adjustment (by subsampling of nonrespondents) for the various biases, persistent or variable, which may be induced by nonresponse.[4] The effective samples are, in fact, self-selected from a sampling frame which itself is neither a complete listing nor an objectively drawn sample of the target population. Furthermore, the information supplied by respondents is not subjected to systematic objective checks.

Various adjustment procedures have been developed over the years in continuing attempts to compensate for inadequacies of sampling and measurement. These include utilization of the relation between past check data and past sample indications on items for which adequate check data are periodically available and the use of direct weighting procedures of varying complexity for other items. The quinquennial and decennial censuses have provided essential bench marks without which many, if not most, of the estimates issued annually would not be possible under the estimating system in use for the last two or three decades. The elimination of even the quinquennial census (without providing an adequate substitute) would deal a damaging and possibly fatal blow to the present system of agricultural reporting since most estimates would drift badly out of alignment in the decade intervening between the decennial censuses. In a real sense, the direct annual outlays of the Division seriously understate the cost of information provided by the Division. A very considerable part of the cost of at least the quinquennial censuses is in fact a part of the cost of providing usable agricultural estimates.

It is quite possible that this patchwork of adjustments performs effectively in the so-called "normal" years, that is to say, in periods of insignificant or gradual change. The procedures used do not perform effectively in

[3] See, for example, *A Program for Development of Crop and Livestock Estimates,* by Sterling R. Newell, a paper delivered at the 117th Annual Meeting of the American Statistical Association, Atlantic City, September 10-13, 1957, and "A Critical Evaluation of Available Agricultural Statistics," by Ivan M. Lee, *Journal of American Statistical Association,* 47, 267-280 (June, 1952).

[4] About a 30 per cent return is obtained from the regular monthly reporter list. Returns from direct-mail individual farm mailings and rural mail carrier distribution average 25 to 27 per cent, U. S. Department of Agriculture, Miscellaneous Publication No. 703, December, 1949, p. 16.

periods of rapid change, that is, precisely at those times when dependable current estimates of national and state totals are most needed. Among the estimates most seriously affected by lack of adequate data in intercensal years are the annual estimates of number of farms, acreages in farms, acreages and production for a number of the major crops, and livestock on farms.

Considerations such as these led quite early to attempts to provide more frequent bench marks. Proposals for an annual sample census began to take legislative form in the 1930's, in connection with the much-discussed Buchanan bill.[5] The efforts to gain approval of an annual sample census approach were not successful at that time, and the proposal dropped into the background shortly thereafter, partly because analysis and testing had not yet reached a stage such that either Census or Agriculture was prepared to commit itself firmly to heavy reliance on this procedure.

The idea was revived in the late 1940's and, as a result of close collaboration between representatives of the two agencies, a cooperative agreement relating to it was signed by representatives of the Bureau of the Census and the Bureau of Agricultural Economics.[6] That agreement has

[5] H.R. 7805, 74th Congress, 1st Session (April 30, 1935), a bill to authorize the Secretary of Agriculture to make surveys of representative farm areas each year in each state for the purpose of obtaining and publishing information upon the economic condition of agriculture throughout the United States and for other purposes. Similar bills had been introduced earlier but for economy reasons had not been pushed vigorously by the government agencies. H.R. 7805 together with the Senate version, S. 2717, had the support of the Secretary of Agriculture, the Secretary of Commerce, the Governor of the Farm Credit Administration, the Administrator of the Agricultural Adjustment Administration, the Acting Chief of the Bureau of Agricultural Economics, the Director of the Bureau of the Census and the Central Statistical Board (see *Informational and Statistical Services Relating to Agriculture*, Memorandum to the Committee on Agricultural Statistics and Information Services of the Central Statistical Board, Mimeo., *Confidential*, September, 1935, Appendices I, II and III). There are, in addition, numerous internal memoranda both in the Department of Agriculture and in the Bureau of the Census which relate to this proposed legislation.

[6] The agreement, dated May 27, 1948, was prepared by a special committee appointed by the Chief of the Bureau of Agricultural Economics and the Director of the Census. It states that "A census of agriculture taken once every five years does not provide adequate information on current changes in American agriculture" and expresses the view that "an annual sample census published each year would be of greater value for those concerned with current changes and with adopting policies and procedures, and modifying decisions and administrative arrangements relating to American agriculture."

The agreement outlines the objectives and advantages of such a sample census and the joint operations to be used in conducting such sample censuses if they are authorized. It further states that "when it is determined that much of the essential information needed by agricultural interests can be secured through these annual sample censuses, consideration should be given to the taking of a detailed census of all farms only once in 10 years, and that such censuses be limited to basic data that can be accurately obtained by inexperienced temporary enumerators." Members of the special committee signing the report were W. F. Callander, Earl E. Houseman and Emerson M. Brooks of the Department of Agriculture; A. Ross Eckler, Morris H.

not been rescinded, but also it has not been put into effect. Its current status is somewhat vague because of the reorganization of 1953 which resulted in the abolition of the Bureau of Agricultural Economics.

The need for modernization of the procedures in Agricultural Estimates led also, in the 1940's, to the initiation and support by the Department of Agriculture of a substantial volume of informal research on sampling and measurement problems. Examples of these are the Master Sample of Agriculture,[7] studies of objective procedures in the estimation of the yield of field crops,[8] the enumerative surveys of agriculture[9] and studies of nonresponse in mail surveys.[10] While this research added significantly to the basic fund of knowledge in this realm and enlarged the professional experience of the staff in Agricultural Estimates, it has had little or no effect on the regular operating program of the Division.

More recently, the Department of Agriculture has undertaken an extensive study of its data-collecting activities with funds specially appropriated for research on improvement of agricultural estimates. The newly established Research and Development Staff has carried on since 1954 large-scale, systematic tests of sample designs for the estimation of basic acreage, farm and livestock totals under conditions closely resembling actual operations in the southern states and, since 1955, also in the North Central states. Much promising work has been initiated on the development of objective estimating and forecasting models for such crops as cotton, wheat, corn and soybeans.[11]

In February, 1957, the Agricultural Estimates Division presented to the subcommittee of the House Committee on Appropriations a major program for development of the Agricultural Estimating Service.[12] The

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Hansen and Ray Hurley of the Bureau of the Census; and M. R. Benedict of the University of California. The report was approved by O. V. Wells, Chief of the Bureau of Agricultural Economics, and by J. C. Capt, Director of the Bureau of the Census.

[7] *The Master Sample of Agriculture. I. Development and Use*, by A. J. King, II. *Design*, by R. J. Jessen, *Journal of American Statistical Association*, 40: 38-56 (March, 1945).

[8] See, for example, *An Objective Method of Sampling Wheat Fields to Estimate Production and Quality of Wheat*, by Arnold J. King, Dale E. McCarty, and Miles McPeek, U. S. Department of Agriculture Technical Bulletin No. 814, February, 1942.

[9] Emerson M. Brooks, "A Report on the General Enumerative Surveys—I," Agricultural Economics Research, I: 37-48 (April, 1949).

[10] See, for example, "Adjustment for Bias Caused by Non-Response in Mail Surveys," by Walter A. Hendricks, Agricultural Economics Research, 1: 52-56 (April, 1949).

[11] See, for example, "Objective Forecasts of Cotton Yield," by Walter A. Hendricks and Harold F. Huddleston, Agricultural Economics Research, 9: 20-25 (January, 1957).

[12] Department of Agriculture Appropriations for 1958. Hearings Before the Subcommittee of the Committee on Appropriations, House of Representatives. Part 2. Washington, 1957, pp. 886-894.

central feature of the proposed program is the establishment of a general-purpose national sample of some 15,000 area segments covering 60 to 75 thousand farms which would provide estimates for major crops and livestock numbers with standard errors of about 1 to 1½ per cent nationally and 5 to 6 per cent for individual states. This sample would be enumerated completely each June to provide estimates of planted acreage and livestock numbers and partially enumerated in the fall to obtain data on harvested acreage, yields and year-end livestock inventories. Other important phases of the program provide for utilization of objective crop measurements in determining production prospects, general application of probability sampling in the collection of price information, and measures for speedier release and distribution of statistical information.

Developments in the Bureau of the Census

In the Bureau of the Census, studies of the feasibility of an annual sample census of agriculture have been under way for several years. In addition, the Bureau has now had some 15 years of experience with the Current Population Survey as a means of obtaining quickly from a relatively small but carefully designed sample a fairly wide range of information on employment, unemployment, and various related matters. That sample, as now constituted, does not provide an adequate mechanism for obtaining agricultural data, though some estimates of farm employment are made from it. Nevertheless, it or something similar might well be explored as to its possibilities of providing additional current data in regard to the population aspect of agriculture.

More pertinent from the standpoint of the present discussion is a recommendation made by the Intensive Review Committee which studied the work of the Bureau of the Census in 1953. That Committee suggested that serious consideration be given to taking during the decade of the 1960's an annual sample census of agriculture and to the eventual discontinuance of the quinquennial census of agriculture. The reasoning back of this was that a somewhat similar amount of money spent on a series of sample censuses could provide broader coverage, more current information and a more useful record of the rapid changes now occurring in the nation's agriculture.

A change of that kind, if seriously contemplated, gives rise to one of the important issues needing to be considered in making some of the decisions relating to the coming decennial census of agriculture. If a well-designed sample census is to be taken in the 1960's, it is highly important that it be initiated immediately after the decennial census or possibly, in its initial stages, integrated with it. If plans based on the 1959 census are not made now, it seems probable that such a program, in the form visualized by its proponents, could not be launched earlier

than 1965 and possibly not until 1970. Hence, the need for resolution of some of the issues involved through decisions that must be made certainly by the end of 1958 and preferably sooner.

It is apparent that a change of the kind implied by the above proposal requires consideration of many factors. There are conflicting interests as to the kinds and amounts of data to be obtained and the timing of releases. There are problems of methodology and questions of who should do what. It is not our intention here to go into this latter problem. It obviously calls for much joint consultation and investigation by the Department of Agriculture and the Bureau of the Census and for collaboration with the Office of Statistical Standards.

The most pressing problem currently is to determine whether a program for a continuing series of sample censuses should be put forward and, if so, whether it should be regarded as an addition to the current programs, including the quinquennial censuses, or as a partial replacement of them. Since this paper is presented primarily for the purpose of encouraging discussion of the problem in all its ramifications, the remainder of it is designed to bring into clearer focus the gains and losses that might be expected to flow from one course of action as against another. Very pertinent arguments can be and are made both for the kind of program provided in existing legislation and for one which some argue would be a desirable modernization of current procedures. While that is true, even those who favor continuance of the existing type of program have other interests which are somewhat in conflict with the positions taken by them.

Some General Considerations

A basic consideration is that of how much total expenditure for the collection of agricultural data should be proposed, with some reasonable prospect of congressional approval, and how it can be allocated as among the different types of activity with a view to making most efficient use of the over-all amounts that can be obtained. Here, some reasonable balance in a broader context must be taken into account. Nearly all branches of the government feel the pinch of inadequate funds for assembling and processing needed statistical information. In an increasingly complex and delicately balanced economy such as ours, the need for more and better data is crucial in many lines. But data collecting is not a type of activity that is easily popularized either in congressional committees or in the minds of the general public.

The amounts appropriated for data collection in agriculture have, on the whole, been on the generous side in comparison with those provided for similar activities in other branches of the economy. There are, of course, reasons for that which are not apparent at first glance. There are

more entrepreneurial units in agriculture than in any other industry. Furthermore, agriculture is not so organized that data can be collected in large segments, as in manufactures, or assembled and analyzed by large and expensive statistical departments such as those maintained by many of the large corporations. But agriculture is also becoming a less prominent part of the total economic activity of the nation. It may be able to retain something approximating its present proportion of the over-all expenditure for data collection, but the prospect for any marked increase in its share is not bright. If this conclusion is warranted, expansion in any given direction will probably have to be offset, in part at least, by contractions in other directions.

Only general orders of magnitude can be given with respect to probable costs of various programs. That is especially true for the sample census since it has not actually been used on a nation-wide scale. The program of development proposed by Agricultural Estimates is likely to cost in all its ramifications around 4½ to 5½ million dollars annually of which, perhaps, 50 to 60 per cent would have to be provided for the general-purpose sample.[13] A complete enumeration of the current decennial and quinquennial type costs in the order of 25 million dollars, making a total of around 50 million dollars for the decade as a whole. A series of annual sample censuses of the type considered by the Intensive Review Committee would probably cost something in the order of 3 million dollars annually or a total of 24 to 27 million dollars for the 8 or 9 intervening years of the decade.

If both the decennial and quinquennial enumerations were to be continued and if an annual sample census were to be taken as well, these and other current activities in the field of agricultural data collection would apparently raise the total for the decade to well over 100 million dollars which would be more than is spent on the decennial population census and several times the costs of the censuses of manufactures, business, mineral industries and other large segments of the economy. If a series of annual sample censuses could be substituted for the quinquennial complete enumeration, the over-all cost per decade would apparently not be greatly in excess of the current level of expenditure.

Differences of opinion in respect to a shift in the direction of annual sample census as against continuance of both the decennial and quinquennial censuses are by no means clear cut and unequivocal. The Department of Agriculture, for example, would like both. A well-designed enumerative type of annual sample is essential to its estimating program. At the same time, it is reluctant to forego the advantages of small-area data brought up to date at five-year intervals. Strong pressure for reten-

[13] This is an informal private estimate which may differ substantially from any (unpublished) cost estimates prepared in Agricultural Estimates.

tion of the quinquennial census also comes from the state commissioners of agriculture, the extension services and from marketing agencies and the agricultural press. Yet, most of these groups also want the broader coverage and more current information that could apparently be derived from a good annual sample.

Unless the small-area data problem can be solved with reasonable satisfaction to these groups, the preponderant interest, in terms of numbers at least, seems to lie with the advocates of complete enumeration at five-year intervals. However, two questions are pertinent. Are there more important needs which would be best served by a sample program? Are there other ways of meeting, to a reasonable extent, the needs of those who emphasize the importance of small-area data?

As to the first of these, the arguments are impressive. A principal reason for initiating the quinquennial census was the contention that agriculture was changing so rapidly that a 10-year interval was too long. Though legislative authorization for a quinquennial census of agriculture was provided as early as 1910, it was not until 1925 that sufficient pressure developed to result in appropriations for taking such a census.[14] At that time, it was argued that the conditions in agriculture had changed so much that new information and new bench marks were needed.

Even in the mid-1930's, there still was some question as to the warrant for a mid-decennial census of agriculture. Appropriations were delayed until it was almost too late to make plans for the enumeration. Again in 1945 and even as late as 1955, there was a noticeable reluctance on the part of Congress to make the appropriations needed, though the legislation authorizing them had long been on the books. Again, however, the need for more up-to-date information about the rapid changes in the nation's agriculture was emphasized.

In attempting to arrive at some conclusion, it is necessary to weigh rather carefully the importance of the various types of use and the degree of accuracy required. It is clear that accuracy and timeliness of over-all estimates rank extremely high in trading operations, in administrative decisions and in congressional attitudes. Accurate county data are important in the administration of some of the agricultural programs, but here timing may not be of such prime importance as in the realm of over-all estimates. For the more general uses such as those made by state agricultural commissioners, marketing agencies and extension workers, reasonable latitude in timing does not create major problems and somewhat larger variations in accuracy can be tolerated without handicapping the users excessively.

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[14] Authorization for a quinquennial census of agriculture was included in the legislation pertaining to the decennial census of 1910, but that provision was repealed at the time appropriations would have been needed for taking such a census in 1915.

Turning now to the second question, assuming that a sample census could be devised that would give excellent national and regional totals and good state totals for most items, would it be feasible to develop, on the basis of state data, reasonably acceptable county estimates derived from decennial enumerations plus supplemental information of various kinds? This would mean applying on a county basis much the same technique as has been used for many years in arriving at national and state totals, first, with a 10-year interval between enumerations and, in recent years, with a five-year interval. The important difference is, of course, that the sample changes on which national and state estimates are based are more dependable than any that could be applied to counties. However, there are now a good many sources of supplemental information that did not exist in the early years of crop and livestock estimates. Among them are the records of the county ASC committees, in some states data from assessors' records or county commissioners of agriculture and, in addition, such indications of trend as could be obtained from the sample censuses and sample surveys that would be included in the program.

Though county estimates so arrived at would of necessity be somewhat rough, they might well serve the needs of most users, notably the agricultural commissioners, the marketing agencies, the agricultural press and the agricultural extension people, better than the currently supplied complete enumerations at five-year intervals. Such estimates could not be expected to be as accurate at the mid-decennial point as the results of the complete enumeration, *but they might well be more accurate in the years between the decennial and mid-decennial counts.* This is because of the rapid changes occurring in American agriculture and the fact that, even with intensive efforts to speed up enumeration and tabulation, the data from a decennial or quinquennial census can hardly be expected to become available much short of a year after the census is taken. Thus, the changes occurring in the course of a five-year period may well result in a larger divergence from the actual than would occur in a series of carefully made estimates.

The principal exception to this generalization would be for items that occur on only a few of the farms in the universe. For these, no sample of reasonable size can be expected to provide dependable totals. For them special surveys or other sources of information would be needed if the uses to be made of the data are sufficiently important to warrant them.

Some Proposals

What are some of the steps that might be taken to move forward to a more adequate and up-to-date program in this realm? It is our view

that the most important step would be the initiation of a large annual, general-purpose sample of agriculture. This would appear to be essential for significant improvement of agricultural statistics. The sample census is the key element in the far-reaching program of modernization of current agricultural reporting proposed by Agricultural Estimates. In conjunction with other information, it is likely to provide a better basis for the development of current small-area data than is afforded by the complete quinquennial enumerations.

It is also our belief that Congress is not likely to approve substantial additional annual appropriations for the improvement of agricultural statistics requested independently by agriculture or census. If we are to move ahead on a program of significant improvement, it will need to be planned within a budget not greatly in excess of the total funds presently provided for the collection of agricultural statistics. This seems to us to be a possibility if the complete quinquennial census can eventually be replaced by a program of annual or biennial sample censuses undertaken jointly by the two agencies.

If such a change is to be made, a number of technical problems must be faced. How large a sample is needed? How should it be designed? By whom and how should the field work be carried out? Where and how should processing and machine tabulation be handled? Some study has been given to these problems and more is needed. However, it seems probable that, given strong leadership, the results of past studies and experimentation and of research now under way could be brought into focus in such a way as to make such a program feasible.

It is suggested tentatively that a sample census, rather closely related to the current decennial and quinquennial censuses, be taken either in October of each year, or in alternate years, on a scale of some 4 to 5 per cent of all farms. If the sample census is taken only at two-year intervals, it is suggested that a subsample of about half the size of the primary sample be used for a sample survey in the intervening years. This subsample could be used for a quick tabulation even in the sample census years to provide totals for the Department of Agriculture's annual summary. Possibilities in the way of timing and speed of operation would need further study but seem not to present insuperable difficulties.

As indicated earlier, there has been consideration in the Department of Agriculture of a sample census taken in the spring. However, from the standpoint of tying in effectively with the decennial complete enumerations, that would seem to have serious disadvantages. It would reduce comparability and would have many of the drawbacks that have led to the gradual shift of the quinquennial and decennial censuses from a spring to a fall date. That shift apparently has had almost universal

support from those concerned with agricultural data. It would seem more logical to base the spring survey on a subsample of the main sample census taken in the fall.

With a basic framework of the kind here suggested, some types of information that now have to be omitted because of space and time limitations in the regular census enumerations could be included from time to time. The bulk of the census schedule must now be given over to basic production and land-use items. This leaves no more than a quarter of the schedule for economic and social inquiries which have come to be so much in demand in recent years. Some of these questions would need to be carried in each sample census, but some could be rotated to provide space for new types of inquiry not now included at all. Alternatively, or perhaps in conjunction with this, it would probably be feasible to lighten somewhat the load now carried by the decennial schedules. That is a change that has frequently been suggested by professional statisticians as a means of increasing accuracy and speeding up tabulation.

Further supplementation on certain types of general information might also be obtained quickly and at relatively small expense if the samples now used in the Current Population Survey of the Bureau of the Census could be expanded or supplemented with a view to providing more adequate representation of agriculture. These surveys, if undertaken, would be best suited for rounding out information about the population aspects of agriculture. Here would be perhaps the most practical means of obtaining more information about farm labor, migrations from and to farms, social security coverage, education, years on farm, and so on. Only national and regional estimates could be obtained in that way, but for some of the more general questions these are sufficient to serve most purposes.

For a program such as that outlined above to operate effectively and smoothly, it would have to be a joint operation by Agriculture and the Bureau of the Census to an even greater extent than has been customary in the past, though there has long been collaboration in the preparation of census schedules and, to some extent, joint use of personnel in census periods. This would need to be carried further, and more closely knit joint administrative arrangements would be needed. In large measure, the primary sample census would have to be designed and timed to meet the needs of Agricultural Estimates though other interests, many of which center in the Department of Agriculture, could also be served. Tabulation would probably have to be so planned as to permit of immediate processing of items of key importance to Agricultural Estimates, while others could and should be given a lower priority rating.

This leaves the problem of the extensive demand for county data on a current basis. Here, as has already been suggested, there is a strong

possibility that a series of currently made annual estimates—based on the decennial censuses, on the indications afforded by the samples and on various types of collateral information—might well be more useful to the users of county data, and possibly more accurate in most of the years between censuses, than the data now provided.

It cannot be assumed that such a plan would solve all of the problems. Some kinds of data would still have to be obtained by means of local surveys. That is particularly true for items that occur on only a small percentage of the farms and for types of production that are very much localized. Some of the data desired and frequently urged by researchers in agencies outside the federal government might still not be of sufficiently wide general interest to warrant their inclusion or may be of such nature that they can only be obtained effectively in the field by professional research personnel. Neither in the Census nor in the Department of Agriculture should agencies designed for the production of aggregative types of data be loaded unduly with requirements for detail that are not in keeping with the nature of the procedures used or of their primary purposes. Refinements of that kind are a problem for the research agencies rather than for the larger data-gathering organizations such as the Census and most parts of the Department of Agriculture.

It is apparent, however, that if annual county estimates of the kind here suggested are to be made and made carefully, this implies some additional responsibility for the offices of the state agricultural statisticians. Many of these offices do carry on work of that kind, but the proposal made would require the acceptance of more specific responsibility and the assignment of specially qualified personnel to that work. There is also, in nearly all of the sample census proposals, an implication of a larger role for the state statisticians.

It would seem appropriate, if an annual or biennial sample census program is undertaken, to use the mass tabulation facilities of the Bureau of the Census with field work carried on jointly with Agriculture under arrangements that would result in the fullest possible utilization of the resources of both agencies. One objective should be that of contributing to the stability of the work load in each of the agencies.

In conclusion, it is important that this large and complex problem be approached in an open-minded and imaginative way without undue emphasis on continuing without change the particular procedures that have grown up in the past. This applies particularly to those who have a strong predilection for continuance of the quinquennial complete census. There are reasons to think that the specific needs of these users could be served as well or better in other ways and that they might also find some collateral advantages from the kind of development here discussed.

However, it is not our purpose here to present dogmatic views. The

whole problem needs further intensive exploration, and open-mindedness should extend not only to the possible advantages of change but also to the advantages of the procedures already in use. But in these days of rapid scientific and technological advance, neither institutional arrangements nor methods can remain static if we are to retain the enviable reputation our agricultural statistical work has achieved.

DISCUSSION: REGIONAL PATTERNS OF TECHNOLOGICAL CHANGE IN AMERICAN AGRICULTURE

GEORGE G. JUDGE
Oklahoma State University

The paper by Stout and Ruttan is a most welcome contribution to the study of technological change in agriculture. Few will disagree with the importance of obtaining knowledge relative to partitioning out the regional impact of technical change, and the project objectives alluded to in the paper appear to be well structured and conceived. Their paper is a good initial effort in the direction of giving us a general flashlight picture of the regional evolution of technical knowledge in American agriculture.

As with any study that attempts to measure something, questions may be raised relative to methods and data. In this respect, this study is no exception, and, therefore, I should briefly like to discuss questions relating to each of these problem areas.

In regard to basic data, the economic researcher usually has pangs of conscience when he uses data in his analyses that were, in many cases, collected for some narrow administrative purpose. Since the model, the data, and the method all play an interdependent role in the estimation process, an important question is raised as to whether the observed data in this case reflects the theoretically specified or desired variables. The analyses given by Morgenstern in his book *Accuracy of Economic Observations* suggests discrepancies between Census and Department of Agriculture estimates of between 4 and 5 per cent.[1] This is a measure of difference only, and each statistic has, of course, its own error which cannot be disclosed by this procedure. Because of this and other limitations of the data, it is my feeling that the observed variables can be considered only rough approximation of the specification they represent. Errors of observation will, of course, always be with us; but it cannot be emphasized too strongly that our analyses will be devoid of meaning unless clarity exists about the quality of the material we use. The defini-

[1] O. Morgenstern, *On the Accuracy of Economic Observations*, Princeton: The University Press, 1950.

tions (composition of the variables) and data employed probably represent the best subjective basic information available. The question is, of course, "Are the data precise enough to permit measurement for the problem under investigation?"

Assuming that the errors of observation can be tolerated, one may then question the adequacy of the methods employed in obtaining information for an unbiased estimate of technological change. The computation and evaluation of measures of inputs, outputs, and technology is a problem in index numbers theory. Unfortunately, whatever indexes we choose are subject to bias. Certain of these possible biases relating to the conditions of factor and product prices have been succinctly conceptualized by George Ladd.[2] Stout and Ruttan also outline other equilibrium, scale, and "neutrality" conditions that must be fulfilled in order to obtain the desired measurements of technological change. I am glad they reviewed these pitfalls because it is important to know what we can't do in order that we don't fool ourselves. However, although the authors recognize certain admissible restrictions, one wonders whether or not they may have been too hospitable in accepting these conditions as fulfilled for their model. Because certain necessary conditions may not have been fulfilled, one might question how successful they have been in separating the impact of technology from other changes which result in increases in either total or per capita output. Until we know more about the discrepancies between these conditions and the data generated by the real world, little can be said about the reliability of the measurements. Relative to the inputs, I find the necessity of using a national rather than a regional price index to deflate the current value estimates of "net inputs" especially troublesome. However, despite the restrictions of data and methodology, the measurements may be adequate for the broad aggregative units to which they are applied. Here again, the adequacy of the results depends on the precision required in the uses for which they are to be put.

Last, I would like to discuss the aggregation problem. Each of the regions investigated represents a major aggregation relative to products, factors, and market structures. For example, the southern region represents firms ranging in scale from plantations to one-mule units and in products from peanuts to the more interesting derivatives of corn. This high degree of aggregation raises a question relative to inferences and economic implications that may be drawn from such heterogenous units. At least there is some doubt in my mind as to how the results should be interpreted. I believe the paper would have been materially strengthened if Stout and Ruttan had given us the potential inferences and economic

[2] G. W. Ladd, "Biases in Certain Production Indexes," *Journal of Farm Economics*, Vol. 39, pp. 75-85, 1957.

implications that they wish to draw from such measurements along with the possible uses for decision making. This would have at least given us an insight into the degree of reliability required by the measurements. I think it is almost definitional that a finer stratification or disaggregation is required if we are to learn something about the ways in which technical change is generated and propagated in American agriculture.

Although I have raised several general questions as to the "goodness" of the estimates, I consider this a stimulating progress report on some very worth-while research. I, for one, will be looking forward to the later editions as this research advances.

DISCUSSION: BETTER BASIC DATA FOR AGRICULTURE

KENNETH L. BACHMAN
Agricultural Research Service, USDA

The problem of better basic data for agriculture as Benedict and Kuznets pose it is essentially one of more data—more basic or crop and livestock production data, more social and economic data, and more local data. They discuss the solution largely in terms of increased use of sampling methods.

They have performed a service in describing recent proposals for increased use of sampling and an annual sample census. Even more useful is their discussion of some of the problems and approaches in making such a change. I believe the replacement of the five-year census by some such series of sample data deserves serious and widespread study. A part of this must be a careful look at our whole statistical program in agriculture.

There are a few points on the increased use of sampling that I would like to touch on. The proposal for an annual census as formulated may imply a routine annual or biannual sample of about the same coverage. I think one of the major advantages in sampling is flexibility. I see considerable advantage in having more flexibility in coverage and content than was suggested. It would seem that in some years a couple of small samples to obtain national estimates might be preferable. Once or twice during the period a relatively large coverage would probably be needed.

Replacement of the five-year census by a series of small samples would mean the direct provision of fewer local data by the Bureau of the Census in the intervening years. This may be inconsistent with meeting the objectives of better local data. As Benedict and Kuznets imply, it would depend largely on the nature of the needs for data at the local level. The agricultural data committee report stressed that more requests for data were made at the county than at the state level, and more at the state

than at the national level. This seems eminently probable. If an average of 100 requests for data are received for each county, this would mean 10,000 requests as the total for a state with 100 counties. The more relevant questions with respect to local data would appear to be along this line. (1) How much significance was attached to the requests? (2) What level of accuracy was desired? (3) What kinds of questions were asked? If the requests largely concerned the current acreage of, say, corn or cotton, the changes in the Agricultural Estimates functions proposed by Benedict and Kuznets may well meet the needs better than a five-year census.

One pertinent point brought out in the paper is frequently overlooked. The replacement of a five-year census of agriculture with an annual sample census of agriculture would require an increase in the surveys and analyses of the type now undertaken by the Department of Agriculture to obtain reliable and reasonably current estimates at the local level. Synthesis and analysis of data already collected should be an important part of this process, in my judgment. There is a substantial body of data from government programs, federal income tax records, and others that might be used more effectively to provide local estimates. But this would require an increased budget for this synthesizing of data.

The need for more social and economic data represents a strong reason for increasing the use of sampling. Social and economic data are often more difficult to obtain. In smaller samples, supervision can be better, and better trained enumerators can be used. In fact, if more and better social and economic data are to be obtained, sampling may be a necessary approach in many instances.

It would be unfortunate to overemphasize the role of sampling as a means of obtaining more and better data with the same inputs. There are other approaches. For example, some attention should be given to the differing degree of detailed agricultural information needed on part-time and residential farms and commercial farms. This may result in substantial savings in both census enumerations and tabulations. Currently, more than a third of the farms are part-time and residential units. I wonder if we need to enumerate, edit, punch, and tabulate local and complete data on agricultural operations, such as acreage and production of oats, soybeans, number of cows milked yesterday, and so on for these farms. In view of the fact that a small part of the income of these farms comes from agriculture, and the fact that they represent a small part of the total farm production and income, perhaps rather general agricultural characteristics would satisfy most local needs for data concerning them.

We need to give serious attention to providing a better analysis of agriculture and farming at the local level from the data obtained in the

census. A clear understanding of and intelligent approaches to the farm problems require information on at least three major groups of farms: (1) Medium to large commercial farms, (2) low-production farms, and (3) part-time and residential farms. If these classes of farms were carried separately, costs could be minimized by tailoring the information obtained and tabulated to the major problems of each of these groups of farms.

This brings us to what I will call the problem of the product mix in obtaining better agricultural data. With any given level of total production of agricultural data, it would appear to be reasonable to assume that the product could be improved by giving close attention to what is becoming more important and changing the emphasis in the questions in line with these trends. Two basic trends that have been underway in recent decades are (1) the growing importance of off-farm work and part-time farming, and (2) the increasing size of commercial farms. Both of these trends carry widespread implications.

Off-farm income sources now account for 45 per cent of the total income of farmers. Even on the medium- to high-production farms, income from these sources has increased from 13 per cent in 1947 to more than a fourth in 1956 according to recent AMS estimates.

To meet the problem of more information on the income of farm families from off-farm sources and use of resources in nonfarm alternatives, we need more data than we got in 1945 or 1950. But here is a problem. The primary information by the census on agricultural and nonagricultural income and use of resources was the Farms and Farm People report, based on the matching of about two-tenths of 1 per cent of the census-of-agriculture farms with the census-of-population data. This provided information only at the level of the nation and three major regions. Such a procedure would be complicated in 1960 if the agricultural census is taken in the fall and the population census in the spring.

But much more important, the current need is for local data of this type. This is particularly evident from the experiences and objectives of the Rural Development Program.

The rapid increases in off-farm income and employment of farm families carries with it the need for increased emphasis on the family and labor resource characteristics as related to their farm resource situation. Data from the census of population are inadequate because no characteristics of the farms these people operate are available. The need for this information will continue to grow with increased off-farm employment and the continued transfer of people into other occupations. It may be even more important if we run into a period of increased unemployment.

The primary avenues open to meet this need for the future are: (1)

a greatly expanded matching of census of agriculture and census of population schedules in 1960, and (2) inclusion of more data on characteristics of farm operator families in the census of agriculture schedules.

The growth in the size of business units in agriculture has also changed our needs for information. The size of commercial farms has increased more than 50 per cent since 1940, going from 220 to perhaps 350 acres. Along with this, there has occurred a tremendous increase in the purchase of nonfarm inputs and capital requirements in farming. These developments increase greatly the need for economic data on the business and financial side of farming, including mortgage debt, machinery inventories, equipment, and production expenses.

There is a tendency to continue to get information that has once been found useful. In view of the recent trends in agriculture, I believe that we should reconsider the relative importance of different types of questions. In this reconsideration, it should be recognized that many things that continue to be of some importance must be considered relatively unimportant because of the rapidly changing characteristics of agriculture.

Finally, I would agree with the major objectives of Benedict and Kuznets to bring under wider review some of the problems that are currently under study in the Bureau of the Census. Changes are needed. Making the correct changes is not easy. Careful review and discussion by all types of users are needed. The decisions can have important effects on agricultural extension, research, and policy.

GATT—A COHESIVE INFLUENCE IN THE FREE WORLD

JOHN M. LEDDY
U.S. Department of State

FIVE years ago the future of the General Agreement on Tariffs and Trade was at best uncertain. Last October, when GATT celebrated its 10th anniversary, it was clear to everyone that "the Cinderella of the international organizations"[1] had become a permanent member of the family. In the words of GATT's Executive Secretary, "today . . . we . . . see the GATT established firmly, as a great international institution enjoying widespread support."[2]

Few enterprises in the realm of international cooperation have traveled a rockier road than GATT. It was born in a period of postwar economic turmoil. It was intended at the time as a provisional makeshift, which many nations accepted only in the expectation that something better would soon take its place.[3] For years its activities were obscured in the shadow of more dramatic international economic programs, such as the Marshall Plan, the work of the Organization for European Economic Cooperation and the "Point Four" technical assistance program. Because it dealt with the sensitive tariff problem, GATT was subject to continuing vigorous attack by protected industries in all of its member countries. The United States Congress, though not asking the President to remove Cinderella from the doorstep, nevertheless looked down its collective nose at her, saying in effect that she might not be repulsive but neither was she fair.[4] Even GATT's name was felt by some to carry unfortunate connotations, which led well-meaning friends to suggest a rechristening.

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[1] From an address by Eric Wyndham-White, Executive Secretary of the General Agreement on Tariffs and Trade, at the Graduate Institute of International Studies, Geneva, Switzerland, in December, 1956.

[2] Same.

[3] The ITO, or International Trade Organization. Negotiations on the GATT and ITO took place simultaneously. GATT was signed on October 30, 1947, and the ITO Charter was completed at the Habana Conference on Trade and Employment in March of 1948. The ITO Charter was a much more ambitious instrument, covering the fields of employment, investment, commodity agreements and international cartels in addition to the commercial policy field to which GATT was confined. ITO, a victim of its own ambitions, could not pass the test of Congressional approval and never came into being.

[4] In the 1951 extension of the President's authority under the Trade Agreements Act, which is the legislative basis for United States participation in GATT, Congress added the following new section: "The enactment of this Act shall not be construed to determine or indicate the approval or disapproval by the Congress of the Executive Agreement known as the General Agreement on Tariffs and Trade." This language was contained in the Extension Act of 1955. It is to be observed that this Congressional aside has no operative force for the reason that trade agreements, such as GATT is, do not come to Congress for approval or disapproval but are entered into by the President under delegated authority.

That the fragile GATT institution has not only survived (with its name intact) but has grown into an effective influence in international economic relations is a remarkable circumstance. The purpose of this paper is to examine some of the reasons for GATT's success.

Conventional basis for "freer trade." A modern writer on international trade theory has observed that, because of the real or presumed benefits which national governments may anticipate from trade restrictions, and because of the supervening demands of special interest groups, an international free-trade system has a natural tendency to disintegrate and must be enforced by some kind of international convention.[5] The judgment holds equally good for modest systems, such as we have today, falling far short of free trade.

In the post-war period the international convention devised for the purpose of preventing the disintegration of the movement toward freer trade has been GATT. The extent to which it can accomplish this purpose is dependent not only on the substance of the "freer-trade" rules which it embodies, but on the observance of those rules by member governments.

To be sure, no set of rules can be inflexible, without various "escapes" and safety valves, or the convention would break under the strain imposed upon it by the divergent pulls of national governments responding to the urgencies of local situations. But neither can the rules be so elastic that they fit with comfort whatever nationalistic trade posture a government may choose to take, or the convention would be meaningless.

In any case, the integrity of the convention requires that such rules as are agreed upon be observed in reasonable good faith, or be suitably changed. Mild rules that are reasonably observed, if not too weak to be useful, are a surer guarantee against disintegration than strong rules that are flouted. I am satisfied from my own observation of GATT's operation over the past 10 years that GATT's contribution as a cohesive influence in the free world owes much to the common sense with which GATT's trade rules have been applied. GATT's contracting parties have consistently promoted observance of these rules by national governments, but they have also agreed to change the rules wherever desirable to meet changed conditions or new circumstances.

GATT as a contract. A distinguishing mark of GATT is that it is a convention of *contractual obligations* between governments which they undertake to observe in applying their national regulations to international trade. It will be helpful to what follows to recall briefly the more important of these intergovernmental commitments:

First, the 37 governments which are parties to GATT agree on the

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[5] Tibor de Scitovszky, "A Reconsideration of the Theory of Tariffs," *Review of Economic Studies*, Summer 1942, pp. 89-110.

maximum level of the tariffs that they will apply to their imports from each other. These tariff commitments are set forth in long and extremely detailed tariff schedules.

Second, the GATT governments agree that absolute import quotas are to be abolished as a normal means of protecting domestic industry from foreign competition.

Third, they agree on the rule of nondiscrimination in applying trade regulations to imported and exported goods.

Fourth, they agree that internal trade regulations, such as consumption or excise taxes, marketing regulations and the like, are not to be used as a means of protection against foreign competition.

These four basic commitments are what might be called the hard core of the contractual trade obligations of the GATT convention. There are also numerous other trade provisions which fill many pages of the GATT document, but it may be said of all of them that they either qualify or supplement the four main commitments which have been outlined—the ceiling on tariffs, the prohibition against absolute quotas, the rule of nondiscrimination, and the prohibition against protective internal devices.

GATT as an Institution. So far, GATT sounds very much like the usual reciprocal trade agreement, with the difference that it is a multilateral agreement among many countries rather than a series of bilateral agreements between pairs of countries. But if GATT were only a multilateral trade agreement and nothing more it is doubtful that we should be hearing of it today. What has given GATT life, and has enabled it to serve its member governments effectively in a world of rapid economic change, is to be found in another ingredient of GATT—that is to say in GATT's institutional arrangements.

Now, the GATT instrument made no provision for a formal international organization such as we find, for example, in the Articles of Agreement of the International Monetary Fund or in the Constitution of the Food and Agriculture Organization. There is no word in GATT about a secretariat, a budget, a governing body, an executive board or any of the usual attributes of international organizations. What GATT did provide, however, was that the Contracting Parties to GATT could act collectively in certain specified circumstances—that is to say, that they could take joint action as a group.

GATT provided, for example, that if a difference of view should arise between governments as to the interpretation of any of the provisions of the agreement, an authoritative opinion could be given by a majority vote of the contracting parties acting as a body. It provided also that if some country should raise a tariff or establish a quota in violation of the

agreement, thus damaging the trade interests of another party to the agreement, the contracting parties as a group could authorize the injured country to take back some of the trade concessions which it had granted to the offending country, thus restoring the balance of reciprocal benefits. It further provided that the contracting parties, acting as a group on the basis of a two-thirds vote, could waive the trade obligations which a government had assumed under the agreement if exceptional circumstances made it wise to do so. It should be noted, however, that GATT cannot place a new obligation on any government, nor can it compel any government to change its trade regulations to conform with GATT's opinions.

These institutional provisions of GATT, though not establishing a formal international organization, have nevertheless enabled GATT to become an effective instrument for settling trade disputes, for promoting the application of GATT's rules for freer trade, and for adjusting the trade obligations of GATT to the practical realities of changing economic situations.

It should be added that these various "organizational provisions" of GATT have now been brought together in a separate instrument—the Agreement on the Organization for Trade Cooperation—and have been submitted to Congress. If Congress approves United States membership, GATT will become a formal organization like the International Monetary Fund. If it does not, GATT will have to continue its work without the improved facilities which the OTC would provide.

GATT's premises. Before looking at some of the substantive activities of GATT, it may be in order to say a word about certain of the assumptions which underlie the GATT operation as a whole. These silent premises, so to speak, are important to an appreciation of what GATT is about.

One may look through GATT in vain for a specific endorsement of the private enterprise system, of the virtues of competition or of the desirability of relying upon free-market forces. Yet the GATT structure is squarely based on the assumption that international trade within the free world is and should continue to be conducted in the main by private traders operating in response to conditions of supply, demand and price in a market economy. It is true that GATT recognizes the existence of state-trading in a few of its clauses. But these provisions are an attempt to set standards for the case of state-trading in particular products. And even in such cases the chief standard applied is that government enterprises ought to behave as though they were privately operated.[6] To put the

[6] Article XVII.

matter another way—if state trading were to become the rule rather than the exception within the free world, GATT would cease to have much value, or, indeed, much meaning.[7]

Neither does GATT speak in the economist's language of promoting international specialization in accordance with comparative advantage. But the GATT rules are intended to produce this result. If governments were now to decide that national self-sufficiency through trade regulation should be the goal of policy, GATT would no longer serve a useful purpose. Governments would have to devise some other means of intergovernmental consultation, if indeed consultation would have a place in such a nationally-insulated world.

A third premise of GATT is that each of the governments which belong to it, large and small, represents an independent nation with sovereign control over its own trade regulations and policies. GATT's work, therefore, is accomplished through negotiation, reconciliation, and the persuasive power of community opinion. The notion of "supranational power" finds no basis in the GATT instrument and is alien to the GATT tradition. This is one of the reasons why the criticism sometimes heard of GATT's voting system of one-country one-vote has so little point. It should be noted also that as a practical matter decisions are most frequently made in GATT not through the voting process but by a kind of consensus approaching unanimity.

Possibly the most significant way in which GATT acts as a cohesive influence in the free world lies in these silent premises themselves. For the premises reflect an important degree of underlying philosophical agreement among a large number of nations representing all continents and all stages of economic development. It is a matter of no small significance that countries as widely separated in size, economic condition and culture as, for example, Germany and Ceylon, or Norway and India, find it preferable to allow their national trade regulations to be debated in the GATT forum and in the light of the GATT philosophy rather than run the risks of unilateral action.

GATT's Work

1. Stabilizing and Reducing Tariffs. For a number of years GATT was thought of as being almost exclusively limited to tariffs. While there is now a wider appreciation of its activities in other fields, GATT's work in reducing and stabilizing tariff levels is still regarded—and correctly so—

[7] It is noteworthy that only one of the GATT countries—Czechoslovakia—has a complete governmental monopoly of foreign trade, and even that country was on a private enterprise basis at the time when it negotiated for participation in GATT (1947). GATT relations between the United States and Czechoslovakia were severed by the joint action of Contracting Parties, at the request of the United States, in 1951.

as its most characteristic function. In a series of negotiations, the first of which began with the establishment of GATT in 1947 and the most recent of which was completed in 1956, GATT countries have exchanged tariff concessions on some 60,000 tariff items affecting about $40 billion of world trade. GATT countries together conduct about 80 per cent of the total trade of the free world and about half of their trade has been made the subject of GATT tariff concessions.

After World War I tariff levels went up all over the world, with the destructive results which are still remembered. After World War II, thanks to GATT, they have come down, and the benefits are being increasingly realized. There is little doubt that GATT's action in the tariff field has not only stimulated international trade directly but has also helped bring about improved economic conditions necessary to the removal of other types of trade barriers, particularly quantitative restrictions.

2. Combating Quantitative Restrictions. The job of eliminating quantitative restrictions on international trade has been slower and tougher. GATT's most important exception to the rule against quantitative restrictions is that which permits the use of import quotas by countries in serious balance-of-payments difficulties. Since nearly every foreign country could claim this dubious distinction in the early post-war years, foreign quota systems were almost universal and discrimination against dollar exports was the general rule. Almost from the beginning of GATT there have been consultations at GATT meetings about these restrictions and their discriminatory application. At times the outlook seemed dim indeed as financial disequilibrium persisted, punctuated by periodic currency crises. Gradually, however, the pattern of restrictions began to loosen. Postwar economic recovery, the salutary work of the International Monetary Fund, the increased freedom of trade and payments within Western Europe promoted by the Organization for European Economic Cooperation and European Payments Union, and the persistence of the GATT contracting parties in pressing for the removal of restrictions—all of these forces helped to bring about a substantial degree of trade liberalization in the years 1953-1957. Full currency convertibility is not yet in sight, but restrictive exchange systems are being steadily dismantled and the rule of nondiscrimination is coming into its own. Governments faced with payments difficulties these days are less inclined to resort to trade restrictions as the automatic cure, and more disposed to adopt the necessary financial and monetary measures to restore equilibrium. For this some share of the credit must be given to GATT.

3. Settlement of Complaints. The GATT's contracting parties, which have now met at 12 major business sessions, have found it necessary to devote increasing attention to the settlement of complaints. Of the 35

articles which make up the GATT instrument some two-thirds consist of detailed trade rules which each of the 37 GATT governments is expected to observe. It is no wonder that problems of interpretation have arisen with considerable frequency, numerous disputes have occurred, and trade obligations have had to be adjusted in several instances. In the handling of these problems between governments, GATT's performance has been little short of outstanding, a fact which has been responsible in large measure for the confidence it today enjoys.

It should be observed at this juncture that GATT has been given no municipal powers by its creators, the national governments. It has no mandate to patrol the highways in search of traffic violators. It is up to country X, if it thinks that country Y is acting contrary to GATT's provisions, to bring the matter to GATT for discussion. Only then does GATT take cognizance.

There is hardly a member government of GATT which has not brought one or more trade complaints in the GATT forum or has not had complaints brought against it. In the great majority of these cases the complaints have been settled in a manner satisfactory to the contending parties and also in conformity with GATT's rules. Complaints about Australian fertilizer subsidies, discriminatory internal taxes in Brazil, excessive French import duties, Greek duties on phonograph records, Swedish anti-dumping duties, German potato tariffs—these are a few of the many issues which the GATT machinery has successfully handled. And for each one of these, many more trade quarrels between governments have been quietly disposed of on the side in the knowledge that if necessary the GATT procedures could always be invoked by the complainant in the case.

Because of the shortness of the remaining time, I am going to skip over some admittedly important areas of GATT's activities—such as its actions in waiving the trade obligations of member countries[8]—in order to get to a current issue of great significance, namely the European Common Market.

GATT and the European Common Market

In January the treaty establishing the Eurpoean Economic Community was put into force. Over a period of years the six economies of Germany, France, Italy, Belgium, the Netherlands and Luxembourg will be gradually merged into a single market. The potential importance of this market to world trade is obviously great. In terms of population it means 160 million customers. In terms of imports the six countries in 1957 imported from other countries about $14 billion in goods, or somewhat more than the total of U.S. imports in that year. Clearly, the way

[8] Mr. Schwenger's paper deals with certain aspects of this function of GATT in connection with U.S. agricultural import restrictions.

the European Common Market develops will have major effects on the course of international trade.

GATT's rules recognize the advantages to world trade of common market arrangements, provided that such arrangements do not result in raising barriers against other countries and provided that they result in across-the-board competition within the common market itself.

GATT and the European Common Market therefore conform in their broad objectives. The job will be to fit the two together in detail. The single tariff of the common market will have to be fitted into GATT's tariff schedules through the negotiating process. GATT countries will have to be satisfied as to how the common market countries are likely to coordinate their policies on other trade barriers, such as in the field of agriculture. Problems will arise as a result of the association with the common market of the French and Belgian overseas territories in Africa, with potential repercussions on world trade in coffee, cocoa, bananas and other primary products.

This work is already under way. At GATT's most recent session in late 1957 the contracting parties created a common market committee to begin the careful task of exploring all these aspects of the new trade relationships which will be created in order to assure that the trade of the free world will be facilitated, and not hampered, as the common market arrangements come into being.

Without GATT the development of the common market in Western Europe could become a mixed blessing indeed, with the danger that its undoubted political and economic advantages for Western Europe might be materially offset by unnecessary damage to the trade of other countries in the free world. With GATT in being, there is an opportunity to secure reasonable assurance that the common market will re-enforce rather than detract from the movement toward trade liberalization in general.

Garden Paths

It is possible to gain some insight into the GATT record by looking at a few of the garden paths along which GATT might have strayed, but did not.

One of these, which opened up invitingly at the very outset—in 1946-47—was the tempting notion that a purely consultative organization, unaccompanied by difficult trade rules and painful tariff concessions, would be a much easier thing for governments to negotiate than the GATT project. Wouldn't it be better, went the siren song, to leave these hard economic decisions to a later time when the world would have recovered from wartime economic dislocations, when financial systems would have straightened themselves out and when there would be a general atmosphere of prosperity? It is easier to answer these beguiling arguments now

than it was when GATT was born in 1947. The answer is very clear—if the governments which negotiated GATT had failed at the time to do what they did, the chance that the liberal trading system provided by GATT would be in effect now would be a very remote one. It is very doubtful that the GATT instrument could be negotiated from scratch today. And the beneficial economic effects of GATT's trade barrier reductions would have been missing over the intervening years.

Another garden path was the defeatism a few years ago about import quotas. GATT, it was said, should give up the doctrinaire approach of trying to enforce its prohibition against protective import quotas. Instead, it should accept the inevitable fact that quota systems are here to stay and try to liberalize trade by negotiations for the elimination of particular quotas in return for particular tariff concessions.

GATT was wise to stick to its basic principle that quota systems should not be used for protective purposes and that particular quotas should be only exceptionally allowed. For the GATT principle is now beginning to pay off. With persistence and patience it seems likely to be the winner in the long run. And whether it is or not, international trade will be better off for the continuing effort.

A third garden path led to the green fields of agriculture. This was the idea that protectionism and regulation appeared to be so pervasive in the agricultural economies of all countries that it seemed hopeless to try to carry out meaningful trade obligations for agricultural products. The waiver for agricultural restrictions granted to the United States was cited as a leading case in point .Therefore, it was suggested, why not drop agriculture from GATT entirely?

It must be admitted that agricultural commodities present a problem of special difficulty. The reduction of barriers to international trade in agricultural products has encountered numerous obstacles and many setbacks. Yet the GATT contracting parties surely chose the best course when, during their basic review of GATT's rules in 1955, they concluded that continued efforts to liberalize world agricultural trade were essential to the very life of the instrument. Despite restrictions on a number of agricultural products, a substantial volume of world trade in agricultural products moves with relative freedom. For many countries, including the United States, agricultural exports are of great importance. A trade program which failed to safeguard these exports and seek to broaden them could hardly be defended on economic or political grounds.

Finally, I would list under the heading of garden paths the temptation to gloss over the real economic and trade problems which have come before GATT, in the presumed interests of diplomatic harmony. It would have been all too easy for GATT to sweep such problems under the bed in the hope that they would be forgotten. To be sure, the GATT institu-

tion has trod carefully. It has prudently forborne from pressing for the rigid application of GATT rules under any and all circumstances and from asking for solutions which do not accord with political and economic realities. Yet GATT has not ducked its responsibilities or compromised the integrity of its rules. Trade complaints and trade problems are carefully analyzed and fully debated with the end in view of reaching conclusions on the merits. This tradition, now well established, has had much to do with making the GATT of genuine economic advantage to its members and not merely a forum for futile debate.

Summation

GATT has not fulfilled the hopes of idealists or free traders. On the other hand, it has done more than cynics would have believed possible or high protectionists would like. GATT's work can be summed up as a substantial measure of practical accomplishment. As the instrument through which a large number of free nations have continued to move in a common direction toward freer international trade, and by means of which they have been able to settle their trade controversies in an orderly and friendly way, GATT has contributed its share toward greater political cohesion within the free world. If GATT were to go out of existence tomorrow, the free nations would have to construct something like it to take its place, or find themselves once again in an era of trade warfare and unrestrained economic nationalism.

SYNTHESIS OF TRADE AND AGRICULTURAL POLICY IN GATT*

Robert B. Schwenger
U.S. Department of Agriculture

IT MUST be a matter of satisfaction that this program, 10 years after GATT (General Agreement on Tariffs and Trade) went into effect, should be presented under the sponsorship of the American Farm Economic Association. During those 10 years, the members of this Association have rallied to the support of the GATT and its trade-expansion objectives. Many of them have given the American public and Congress the benefit of their testmony that American agriculture stands to benefit greatly from GATT—as an export industry, as a seller to American industrial society which prospers with trade expansion, as a consumer of imported products, and as an integral part of the American economy.

But this testimony as to benefit to agriculture has been over-shadowed by the impression generally conveyed that there is a conflict between GATT and agriculture. More specifically, it is said that GATT envisages the elimination of quotas that restrict imports and of subsidies that stimulate exports, while our price-support programs require just such import quotas and export subsidies. Sometimes this is presented as a conflict of law; our farm legislation requiring one thing, GATT another. Sometimes it is presented as a conflict of basic policies: laissez-faire on the trade side; government intervention on the agriculture side. The conflict is often said to be irreconcilable.

This impression of conflict, whether of policy or of program, has disturbing repercussions. It is used as a criticism of United States agricultural programs. It is an effective weapon for attacking GATT. It confuses efforts to use our surpluses constructively in countries that need them but lack the resources to purchase them in sufficient amount. An idea having such unfortunate effects deserves close examination. And it does not stand up.

The words "conflict" and "inconsistency," and especially "irreconcilability," express, at best, only one aspect of the truth. The most significant fact about the relationship of GATT to agricultural programs is very nearly the opposite. GATT contains a set of provisions drafted for the specific purpose of reconciling the essential rules of trade expansion with the essential requirements of agricultural support programs—not just price-support programs but all kinds of farm support programs. The purpose of this paper is to suggest that greater emphasis on those provisions and more economic analysis addressed to their application can

* The views expressed are the exclusive responsibility of the author. They do not express government policy or have official sanction.

contribute to international cooperation and understanding and toward a synthesis of policies in dealing with agriculture-trade problems in the Free World.

The Underlying Agreement

If one considers the circumstances in which GATT was negotiated, it is obvious that it had to be drawn so as not to conflict with agricultural programs. In 1947, even though agricultural products were scarce and human need was great, the producers of the world lived in real fear of surpluses. Production was being restored in the war-devastated areas and the technological advances of the war period were being applied in wider and wider areas. Farmers remembered 1921 and the years that followed. In order to get maximum production for urgent present needs, therefore, almost every government gave its farmers some sort of guarantee against future income declines. As a result, when it came to trade-expansion undertakings, no government could make a commitment that would interfere with its programs for living up to its farm guarantees. Moreover, each government feared that, when surpluses did appear, the farm programs of the other governments would hurt the trade of its farmers, and it insisted that GATT prevent this. The various national farm programs differed greatly, but GATT had to reconcile them all with one another and with trade-expansion before governments would accept it as a basis for working together in economic peace.

The provisions that were finally accepted for this purpose are scattered through GATT, but they were conceived in considerable part as a unit. Though they are not complete or perfect, their intention is clear enough if they are looked at as a whole. The underlying points of agreement might be summarized as follows:

(a) In agriculture, as in other sectors of the economy, resources should be used fully, and production and trade should be expanded according to an economic pattern. This objective will be furthered by reducing government intervention in trade.

(b) When there are agricultural surpluses not susceptible of removal in a reasonable time by the response of demand and supply to severe price decline, governments often intervene to support domestic agricultural incomes.

(c) To the extent that a farm support program distorts production and trade, the government should be fair—in setting quotas, subsidies, and all the rest—to the legitimate trade interests of other GATT countries. The principal criteria of fairness are:
   (i) Trade in previous representative periods, and
   (ii) Changes in comparative international advantage.[1]

[1] Expressed variously as the shares of trade "which might reasonably be expected . . . in the absence of (trade, marketing or production) restrictions" (GATT, Art. XI, Paragraph 2, concluding section); "relative productive efficiency" (GATT, Art. XI,

(d) When a difference arises as to what is fair in a specific commodity case, the interested GATT governments are to consult with one another and seek agreement. Intervention pursuant to agreement among the interested governments is generally exempted from the detailed GATT rules.

That's about it. Conflicting theories were compromised. Various national panaceas cancelled one another out. The result was just an agreement to live fairly together and keep in touch so that we can understand one another and cooperate as we work toward the best use of our farm resources. The provisions spelling out this agreement are in force among 36 countries doing over three-quarters of the world's trade.[2]

In the confusion that has marked international economic relations generally in the turbulent postwar decade, governments have been slow to apply GATT agriculture provisions. But they are doing so more and more as time passes and as they find the challenges and compulsions of the present-day world bringing them back to the simple GATT logic and realism. Currently they are elaborating and clarifying their common understanding of the provisions in a number of ways. There is still a good way to go. Discussion among economists is helpful.

The next part of this paper discusses the detailed GATT provisions, first on import quotas and then on subsidies, that bring out the underlying agreement regarding agriculture.

Import Quotas

As concerns import quotas, GATT provisions appear rather precise. In practice, however, they have developed toward flexible application on the basis of fairness and reasonableness.

Article XI lays down the general rule that there shall be no import quotas, but it makes a permanent exception for import quotas on an agricultural commodity provided that (a) domestic production or marketing of the commodity is also restricted, and (b) imports are permitted the share of the domestic market they would have had if there were no

Notes and supplementary provisions); satisfying requirements from the most effective and economic sources (GATT, Art. XX, Notes and supplementary provisions, referring to Resolution 30 (IV) of 28 March 1947 of the U.N. Economic and Social Council, referring in turn to the Report of the First Session of the Preparatory Committee of the United Nations Conference on Trade and Employment, p. 36, Art. 53, principle 5); and envisaging a share even for a country which had none historically (GATT, Art. XVI, Section B, Paragraph 3, Notes and supplementary provisions).

[2] As chairman of an interdepartmental working group charged with drafting trade-agriculture provisions that might meet wide intergovernmental acceptance, the author of this paper had an opportunity to bring together a statement of the argument looking to the above points of agreement. That by-product of the original drafting of GATT provisions on agriculture was published in the February, 1945, issue of the *Journal of Farm Economics* and was incorporated by Dr. O. B. Jesness in "Readings on Agricultural Policy," 1949.

restrictions on production, marketing or imports. In determining that share, it is provided that there shall be considered: (a) the representative historical share that imports have had, (b) changes in relative productive efficiency, and (c) any other special factors that may be affecting the trade. If an interested government so requests, the restricting government agrees to consult with it regarding adjustment of the quota according to these criteria.[3]

At first there was no problem. Food and fiber were scarce. Farm prices were high. Pressures for import restriction obtained little support. When surpluses did appear, however, it turned out that only the dollar countries were expected to comply with the quota provisions. The others, including the great agricultural importing countries of Western Europe, were in balance-of-payments difficulties. It is not at all clear that GATT rules permit greater agricultural protectionism under balance-of-payments quotas than under agricultural quotas, especially if protection continues for the same commodity year after year. But the world sympathized with these countries, and their extreme quotas, usually coupled with efforts to expand their domestic production, went largely unchallenged.[4] By 1950, however, the CPs (for "Contracting Parties," i.e. Member Governments in GATT-ese) were sufficiently disturbed at this turn of events to publish a report pointing out the widespread misuse of balance-of-payments quotas and suggesting methods of carrying out the obligation to remove them as rapidly as possible.[5] Beginning in 1952 (as required in the balance-of-payments provisions of GATT) the CPs held consultations to keep the quotas under scrutiny. Looking back, it is interesting to note the different sources, just in the United States, of opposition to starting these consultations: There was concern that European recovery might be hindered; there was concern that protective quotas the U.S. might adopt could become the subject of consultation; some United States commodity groups hoped to export more under aid programs than by getting quotas enlarged; and some proponents of trade expansion were concerned that GATT might fail and be discredited. However, the consultations were started, and they have grown in importance. The consultation technique appears to be proving itself in the world of today.[6] But there are still many quotas protecting agriculture behind a balance-of-payments

[3] This last provision is in Article XIII, paragraph 4.

[4] The use of balance-of-payment quotas by underdeveloped countries in place of development quotas is not dealt with in this paper. It raises a question about the GATT provisions not usually associated with agricultural policy.

[5] "The Use of Quantitative Restrictions for Protective and Commercial Purposes," GATT, Geneva, July 1950. See especially pages 12 and 13.

[6] For a report from the point of view of United States agriculture, on the special balance-of-payments consultations held last June, see Foreign Agriculture Circular FATP 22-57 of September 13, 1957.

facade—even in some countries coming out of their balance-of-payments difficulties. This is a continuing problem.

On the United States side, there has been relatively little use of import quotas on agricultural products not restricted domestically in one way or another. In only a few cases has the fairness of the quotas been seriously challenged. From the first, however, there was apprehension over Article XI in the United States, where agricultural production had expanded so greatly for war and relief needs. It was thought that GATT criteria of fair shares of the market might be used to force a return to out-of-date, prewar patterns of production and trade. In the discussion, much was made of resentment against the foreign quotas which were keeping out our farm products year after year. Old slogans, such as the "American market for the American farmer," were revived. It was feared that foreigners might sell in the U.S. at any price just to get dollars. In this situation, it was widely believed that there is a legal conflict between GATT and Section 22 of the AAA. Technically, GATT requires that agricultural import quotas be matched by domestic restrictions, while Section 22 requires quotas to prevent interference with programs whether or not they restrict domestically. But technical conflicts can be removed if there is no basic conflict involved in them. Essentially, therefore, the question is whether the fair share of the market of the GATT undertakings would constitute interference with a program in the meaning of Section 22. Since neither is a precise measurement, reasonableness on both sides in a specific situation can probably avoid basic conflict. But there was great confusion about it. Congress finally made clear that, if there were to be an actual conflict in a specific case requiring decision, Section 22 was to prevail over GATT commitments.[7] Meanwhile, some of the specific actions taken under Section 22 were held by the CPs to impair U.S. tariff concessions. One government (the Netherlands) was adjudged to have demonstrated a measurable amount of specific damage.[8]

In this situation, both sides—that is, the European importers with balance-of-payments quotas but the prospect of no balance-of-payments difficulties to justify them, and the United States with quotas on some supported commodities with no domestic production or marketing controls—took steps toward restoring the underlying GATT understanding. Each asked the CPs to waive GATT quota obligations. Each declared its

[7] Edwin G. Martin, "The Conflict Between Foreign-Trade Agreements and Price-Support Programs," Cornell Law Quarterly, Vol. XXXVII, No. 1, Fall, 1951.

[8] The value equivalent of 13,000 tons of flour. The United States had at first protected some agricultural products under its wartime absolute quota powers (designed for the sharing of scarce products but extended for protection). These restrictions were later transferred to the Section 22 authority, without enough change, in the Netherlands instance, to satisfy the CPs as to their fairness.

intention to make a real effort to alter the situations requiring the quotas. Each agreed to discuss the matter regularly with the CPs. The CPs agreed. They granted a temporary waiver for the so-called "hard core" of agricultural quotas that could not be removed for protective reasons when a government emerged from balance-of-payments difficulties, provided there would be a clear demonstration of need in each commodity case, provided that the restricting government would undertake to develop and apply measures to ensure the elimination of the restriction over a "comparatively short" period of time, provided it would give a fair and reasonable share of the market to other countries and would not discriminate against dollar countries, and provided it would submit an annual report to serve as the basis for an annual review by the CPs.[9] The United States, on its side, was given a waiver from GATT obligations for any action required by Section 22, provided that the U.S. would review any quota at the request of a GATT government, give notice of the consideration of, and decisions regarding, any new or modified restrictions, remove or relax restrictions as soon as circumstances permit, and furnish an annual report to serve as the basis for an annual review by the CPs.[10] The U.S. stated that Section 22 was needed to control abnormal imports attracted by support programs and that the United States would continue to seek a solution of the problem of surpluses.

In the annual reviews under the Section 22 and "hard-core" waivers and in the related balance-of-payments consultations, official attitudes become less doctrinaire and more understanding of specific problems—less legalistic about domestic production control and more insistent on reasonableness and fairness—less certain about elimination of import quotas and more firm about accountability for their administration. In this way, the basic GATT understanding is being clarified and developed. Opinion is being focused. Informed analysis by economists and sensitive

[9] There is much of interest for economists in the criteria discussed in the report of the GATT Working Party which recommended the terms of the waivers for Belgium and Luxemburg, the two countries which have thus far qualified. Basic Instruments and Selected Documents, GATT, Geneva, February 1956, pages 102-113.

[10] In spite of the waivers, it should be noted, governments whose interests are harmed by the quotas can, as the Netherlands does, obtain approval for compensation or for withdrawal of concessions to the extent that they can prove damage. GATT is essentially a contract between governments (a) to maintain certain tariffs at not more than specified levels and (b) not to take any nontariff action harmful to one another's trade interests. The general provisions regarding quotas, subsidies and the like are guides toward the kind of nontariff action which will avoid such harm—or impairment, as it is called. The less intervention, they point out in a general way, the less harm. A violation of a general provision, where no harm can be shown, may be discussed by the CPs; but no claim for compensation or withdrawal will be approved. On the other hand, if there is measurable harm, a claim for equivalent compensation or withdrawal may be approved even though the general provision has been waived—even, in fact, where there is no violation.

theoretical discussion in this field should help delineate perimeters of fairness and evolve criteria of abuse.

Subsidies

The original GATT provisions on subsidies, unlike those on quotas, were deceptively general. They went largely unheeded by some and over-observed by others, until the growth of surpluses led to danger of economic warfare. Currently, governments are moving back toward the underlying GATT understanding in several forums. Progress seems most promising in FAO (the United Nations Food and Agriculture Organization).

Article XVI provides that a member government shall notify the CPs of a subsidy which operates to increase exports or to reduce imports. It undertakes to discuss with any other GATT government, on request, the possibility of limiting the subsidization so as to avoid serious prejudice to the interests of other GATT countries. The intention is that consultation thus begun shall be pursued until agreement is somehow reached.

In addition, there are some provisions relating just to export subsidies, which I will come to in a moment. Let me first note that this obligation to consult with countries whose interests are affected extends to all government subsidies—indeed, to all support programs. The GATT text reads, "any subsidy, including any form of income or price support, which operates . . .to increase exports . . . or to reduce imports." Writers dealing with the advantages of programs of direct payments supplementing producer incomes as a method of farm support[11] sometimes claim that such programs avoid conflict with GATT because they require neither import quotas nor export subsidies. But the advantages over other farm-support techniques, however great they may be, cannot alter the fact that these programs tend to give the domestic producer an absolute advantage in competition, both for the domestic market and for the export market. If the programs are open-end,—i.e., if their stimulation to domestic production and marketing is not limited in some effective way—they distort trade and may seriously damage the trade interests of competing foreign producers. Under the GATT provisions, the government operating such a program obliges itself to discuss with other governments the limiting of the program to avoid such prejudice.[12] Income-payments programs seem peculiarly adapted to the farm-support needs of importing countries. The governments which use them extensively (e.g., the United Kingdom) have been reluctant to report them and to

[11] This is sometimes associated in discussions with the imposition of a tax on the first domestic processing of the commodity as a source of the money for the income payments—also claimed to avoid conflict with international trade interests.

[12] As a matter of fact, under Article XXIII, a GATT government undertakes to consult sympathetically with any other GATT government which considers that the benefits of GATT are impaired for it by any situation whatever.

submit to inter-governmental discussion as to the extent to which imports are inhibited by them. But the GATT undertaking is clear. It is my view that, as confusion over the GATT agriculture provisions clears away, the logic of events will work toward its observance. The underlying GATT understanding could not prevail if answerability for unfair damage to trade could be avoided merely by altering the *form* of a farm-support program.

There were originally no separate GATT provisions regarding export subsidies. A text had been agreed to, but it was discarded. It was a drafting nightmare which bore the marks of a struggle between U.S. negotiators who would not agree to the elimination of export subsidies and negotiators for some of our agricultural competitors who insisted on eliminating them. The last-minute compromise condemned export subsidies in general but permitted them on agricultural products as long as they did not take more than an equitable share of world trade for the subsidized producers. The main criteria of equitability were the share in a previous representative period and the desirability of expanding exports from the most effective and economic sources. These provisions, drafted more intelligibly, were subsequently incorporated in GATT.

But discussion of export subsidies by the CPs proved almost as difficult as discussion of income-payments subsidies. Governments which subsidized exports indirectly—as by foreign-exchange manipulation, bilateral agreement or special deal—were reluctant to report. Even some paying export subsidies in a direct form found reasons for not reporting. The payments offset exchange-rate complications, or they were made by a government-sponsored monopoly or quasi-governmental board for which the government would not answer. The GATT text itself specifies three types of export subsidy which it does not cover. There was great confusion as to what a subsidy is, wherein it differs from private dumping and how it affects competing interests.

Meanwhile, some governments with fixed price supports withheld export subsidization and accumulated stocks, while others expanded their shares of world markets. Stocks rose to peak levels. There was widespread fear that they would be dumped on the world market unfairly. There was an ominous quality of asperity in the exchange of public remarks among friendly countries—as though they were on the verge of economic warfare. But reasonable council prevailed and restraint was exercised. In the Committee on Commodity Problems of the FAO the question of defining an export subsidy was avoided by focusing discussions on government surplus disposal abroad, whether or not the method was recognized as an export subsidy. Some principles of surplus disposal were drafted, and were accepted by governments. Like the GATT provisions, they emphasize shares in a representative base period and the "normal" pat-

tern of production and international trade. They put more stress on the desirability of increasing consumption and less on comparative advantage. A special committee was set up to meet frequently for consultation on specific surplus-disposal actions. There are still a number of government aids to export not reported, but the discussions appear to be widening. In particular, they are tackling the problem of using surpluses to help development progress in underdeveloped countries without stirring up a hornet's nest among established trade interests—a long sought combination. Economists are giving increasing attention to these questions and can help greatly.

What is Fair?

It will be noted that the GATT provisions look to friendly intergovernmental consultation to settle differences as to whether a given quota or subsidy is fair to the trade interests of the other GATT countries. The CPs almost always accept agreement among interested governments as conforming to the GATT, even if it involves the violation of the GATT rules. They are not concerned whether the agreement is reached formally or informally—in bilateral discussions, in GATT consultations or in some other intergovernmental forum. It may even be tacit, if the governments so desire. But if no agreement can be reached in any forum, the CPs themselves estimate the share of the market which is fair in a given case—and, if there is injury on the basis of that estimate, they will approve withdrawal by the injured government of a commensurate value of trade concessions.

GATT does not favor formal international commodity agreements, but in a situation of burdensome world surplus, it permits government measures under such an agreement to satisfy the criteria of fairness—and it excepts such measures from GATT provisions—provided that the agreement conforms to certain principles approved by the United Nations Economic and Social Council.[13] This is a key to the thinking of the negotiators of the GATT agriculture provisions. In the preceding paper Leddy pointed out the basic GATT premise that principle reliance in trade matters should be on the responses of private individuals to conditions of supply, demand and price in a market economy. GATT agriculture provisions recognize that some farm commodities at some times may be characterized by special difficulties—such that, when price declines, the

[13] The agreement must not exclude any interested country and must give equal voice in its decisions to importing and exporting countries. It must treat fairly with all countries so that no government is forced to intervene in self-defense. It must be reviewed every three years. It must operate openly in all respects and must look toward supplying the commodity increasingly from the most economic sources. GATT, Article XX, Paragraph 1, Subparagraph (h) and Notes and Supplementary Provisions thereto. The above summarizes only the more important of the U.N. principles.

mechanism of the market economy may not restore farm incomes fast enough to satisfy some governments, and they may intervene actively in those portions of the market economy for the commodity falling within their national jurisdictions—each doing in its part of the market what it thinks will set the matter straight. GATT agriculture provisions are based on the premise that such intervention should not be at the expense of the trade of other countries. Thus, there is no basic conflict with domestic farm support programs. GATT provisions have no bearing on whether there should be supports or what form the supports should take. They require only that, if there are supports, they shall be fair to other GATT countries, and that fairness shall be a matter of discussion and agreement. They are thus calculated to limit and reconcile conflict over national programs and to minimize disintegrating effects on the world market for the commodity .

Conclusion

In concluding, I would like to suggest that the GATT agriculture provisions are capable of playing a useful background role in Free-World efforts to meet the challenges and opportunities of our exciting times. The importance of having a set of ground rules regarding the relation of farm support programs to trade expansion and to one another is particularly great at the present time when programs are so numerous.[14] Governments are groping for common understanding in a dozen forums with an imposing array of initials: GATT, CCP, FAO Council, ICCICA, CICT, OEEC, ICAC, IWA, International Sugar Council, and a variety of study groups, subcommittees and working parties. And more are in prospect. Last month the CPs set up a group of four experts to analyze the world commodity situation for them and, almost simultaneously, the FAO Conference decided to undertake a study of the international effects of national price policies. This proliferation of forums is partly an evidence of the complicated subject matter and the difficulty of achieving lasting agreement between governments on specific commodity trade. I believe, however, that it is also an outgrowth of confusion as to where governments stand on simple basic principles. I am convinced that it could be helped by focusing on the underlying GATT understanding to which so many governments have subscribed—and by amplifying and perfecting and especially by firming that understanding.

[14] "Government intervention in agriculture . . . is standard practice throughout the world. . . . Practically all Free World countries today provide price and income support to agriculture. . . . Practically all countries rely heavily on some forms of trade regulation to carry out their policy objectives." "Agricultural Policies of Foreign Governments," U.S.D.A., FAS, Agriculture Handbook No. 132, September 1957, pages 1 & 2. Taken out of context, this may overstate the case, but it is indicative of extensive intervention.

The prospect of food and fiber enough for all—offered by modern technology—is transforming what has been only a mystic vision for the low-income millions of the world into a secular determination driving governments (and sometimes flouting economists). The high-income countries are taking up the challenge to make their trade institutions serve the aims of those populations. It is in the Free World that agriculture is producing abundantly—not elsewhere. It is in the Free World that we have surpluses. But our efforts to put them to constructive use—to derive benefit from our present productive superiority—which may prove transient—are hampered by fears for commercial interest. Small fears can hobble great efforts. The GATT provisions and FAO principles contain criteria for measuring commercial interest and undertakings to protect and advance it. Properly followed up, they not only can reconcile agriculture and trade policies; they may actually lead to a dynamic synthesis which will facilitate getting on with the big job.

DISCUSSION: GATT A COHESIVE INFLUENCE IN THE FREE WORLD*

OSCAR ZAGLITS
Foreign Agricultural Service

As Leddy has described GATT, it is not an arrangement for 100 per cent free trade; nor is it an "inflexible set of rules." But it is an effective instrument for facilitating mutually beneficial expansion of trade.

At the time when GATT was negotiated, the volume of world exports was roughtly equivalent to its low prewar level. By value, world exports amounted then to about 50 billion dollars. By 1957, their value had risen to 100 billion dollars, mostly because of a phenomenal increase in the volume of world trade.

Many factors have contributed to this increase. Thus, it is not possible to measure, in terms of a definite figure, the contribution made by GATT. Yet, it seems reasonable to conclude that world trade would have expanded less if GATT had not united the principal trading nations of the world in the pursuit of policies working, as Leddy has noted, toward "international specialization in accordance with comparative advantage."

To appraise the change in world trade conditions brought about by what Leddy has termed "the premises of GATT," we need only to compare the interwar experience with that after World War II. Then, the tariffs of many countries were raised to higher and higher levels and, from the 'thirties on, tariff protection was reinforced by extensive recourse to quan-

* The views expressed in this paper are those of the author.

titative import restrictions. In contrast, after World World II, the multilateral negotiations under GATT resulted, as Leddy has pointed out, in concessions by many countries on some 60,000 tariff items, or on about half of the trade among those countries. Initially, the value of many of the tariff concessions was impaired by the extensive quantitative import restrictions that countries in balance-of-payments difficulties continued to apply. In recent years, however, most of the industrial countries have freed a large part of their imports from quantitative restrictions. In addition, they have considerably liberalized the administration of many of the remaining restrictions.

A number of countries experienced new financial difficulties in 1956 and 1957. Yet, with two or three exceptions, they have avoided tightening their trade and exchange controls. Instead, they have attacked the causes of those difficulties by means of disinflationary policies. GATT and IMF certainly deserve credit for this change in attitude.

The most important new development confronting GATT at this juncture is the creation of a *common market* of six European countries. This will be one of the major matters before GATT for years to come. Leddy has briefly described the principal problems that will arise therefrom. I would like to add a few words about the problems in the *agricultural* field. Five of the six countries, namely Germany, France, Italy, Belgium and Luxembourg, have at present highly protectionist agricultural policies. Even in the sixth country, Holland, government intervention in agriculture is of a comprehensive nature. There are, however, substantial differences among the six in the type and degree of government intervention in agriculture. Therefore, it has not been considered feasible to bring about a common agricultural market simply by means of reducing intra-area tariffs and liberalizing intra-area trade restrictions. Special transitional arrangements in the Common Market Treaty permit the imposition of minimum import prices and provide for expanding intra-area agricultural trade by means of long-term contracts. Ultimately, a common agricultural policy and common agricultural institutions are to be developed. In their common agricultural policy, the six will aim at increases in agricultural efficiency and at more rational production patterns. Inevitably, a high degree of discretion has been granted the institutions of the six in the agricultural field.

The way in which this discretion will be used will, of course, affect third countries as well as the six. Many agricultural exporting countries voiced fears in this respect at the recent GATT session. Spokesmen for the Common Market, on the other hand, stressed that, as productive capacity and levels of income rise, the six will increase their imports from other countries. The composition of these imports is likely to change, however.

An understanding has been reached at the last GATT meeting for continuing consultations between GATT and the institutions of the six on agricultural as well as on other matters. The task of reconciling the Common Market agricultural policies and GATT will be even more difficult than that of reconciling GATT and the U. S. agricultural policies. I share, however, the hope that the consultations with GATT offer, as Leddy has said, a reasonable assurance that the Common Market will not detract from the movement toward trade liberalization but rather will reinforce this movement.

Thus, these consultations should help American agriculture in its efforts to maintain and, where possible, to expand its European markets.

DISCUSSION: A DECADE OF GENERAL AGREEMENT ON TARIFFS AND TRADE

ERNEST T. BAUGHMAN
Federal Reserve Bank of Chicago

The papers presented by Leddy and Schwenger cover somewhat different territory but have much in common. That the General Agreement on Tariffs and Trade (GATT) has survived its first 10 years is acclaimed as quite "remarkable." To hear the instrument described as "a permanent member of the family" of international institutions is somewhat reassuring. At the same time, it is somewhat disconcerting that so much emphasis is placed on the fact of survival itself. Granting that GATT was "born in a period of economic turmoil," has been obliged to travel a "rocky road" and was accepted initially by many nations "only in the expectation that something better would soon take its place," we nevertheless must look beyond longevity for a measure of usefulness. The papers possibly could have served up a somewhat richer broth on this count.

Apparently the greatest contribution of GATT, and it is by any measure a substantial one, has been the provision of a forum in which public opinion can be marshalled in support, or opposition, of specific international trade policies and practices. A central operating principle appears to have been to "keep disputants talking and eventually they must agree" on something which will not be so far afield of the "silent premises" on which GATT is based that it cannot be endorsed.

Agricultural surplus disposal is recognized as presenting both a thorny problem and an opportunity to provide assistance to low-consumption areas. Reference is made to a growing interest in the search for techniques of expanding world food and fiber consumption "without competing unfairly" for markets. However, there is reason to doubt that efforts to fit agricultural surplus disposal programs into a framework of essentially

commercial international trade can be expected to show satisfactory results. Surplus disposal programs which seek to achieve increased consumption in low-consumption areas probably would be much more effective if considered foreign aid at the outset and handled as such. This would go a long way toward eliminating their interference with the commercial trade in agricultural commodities. It will be most unfortunate if GATT, in its attempts to digest government financed surplus disposal programs within the framework of "commercial" trade policy, finds it has tackled an insurmountable obstacle.

Leddy includes the "garden path" of agricultural protectionism in a list of tempting byways which could easily have resulted in a permanent and disastrous detour for GATT and gives some hint of a feeling of uneasiness relative to the exceptions granted agricultural commodities and the possible future impact of these exceptions on GATT.

Schwenger, on the other hand, holds the view that the exceptions granted agricultural commodities were necessary and justifiable and further, that there is no significant "inconsistency" or "conflict" between the GATT provisions and national agricultural programs. In a precise, legalistic sense this apparently is true. In a broader sense, however, as Schwenger recognizes, there *is* a widely held view that basic conflicts *do* exist between the principles and objectives of relatively free trade and the raiment of nationally determined prices for commodities produced for export.

Schwenger takes the very practical position that GATT recognizes the existence of national agricultural support programs, and that the current need, therefore, is to move ahead on the trade front by developing additional objective means of bridging the gap between "liberal" international trade policies and the trade postures which result from "nationalistic" agricultural programs. These may be found, he suggests, within the framework of objective measures of "what is a fair share" of the market.

A major question arises, however, as to what is the best method of seeking further reductions of barriers to international trade in agricultural commodities. Does it lie in the direction of attempting to develop objective criteria for judging "what is a fair share" for each country with respect to every time period and every commodity? Or does it lie in bringing to bear the maximum possible influence to minimize national programs which tend strongly to interfere with international trade? Experience under U.S. agricultural programs provides little support for the view that market sharing concepts, based largely on "representative" historical experience, can show the flexibility required to provide an effective distribution of supplies which vary both seasonally and annually, and to achieve for consumers the benefits of technological advances and shifts in comparative advantage.

This discussant cannot escape the feeling that the structure of international trade in agricultural commodities remains shaky—that basic conflicts of policy and objectives do exist. GATT undoubtedly has made a significant contribution to the easing of trade barriers and the avoidance of serious outbreaks of competitive subsidization of exports. Given continued forbearance on the part of the United States and other important exporting countries, it may continue to enjoy a considerable degree of success. However, the building of a firm structure of international trade in agricultural commodities may require a foundation which is more readily susceptible of definition, more flexible, and more impersonal than are international agreements as to "what is a fair share" of particular markets. Certainly it is to be hoped that continued discussions and negotiations within the framework of GATT, or similar international institutions, will make further positive contributions to the freeing of world trade, in agricultural as well as manufactured commodities and minerals.

DISCUSSION: A DECADE OF GENERAL AGREEMENT ON TARIFFS AND TRADE

GEORGE L. MEHREN
University of California

These two papers represent the opinions of two government officials who have been associated with GATT continuously since its initiation some 10 years ago. The opinions may well be valid. However, neither paper is so written as to compel acceptance of the conclusions set out by the authors. Both papers suffer from severe analytical limitations. Neither paper purports to be analytical in structure. While there is explicit advocacy in both papers, the argument is not supported by appropriate logical development. There are fallacies—even for advocacy. Both papers indicate that certain trade occurrences contemporary with GATT must therefore have been caused by GATT. Presumably, the conclusions must have been developed either from some empirical analyses or from some process of logic. These bases are not specified and can therefore neither be supported nor refuted. Finally, the papers omit references to important facts which are crucial to the limited theses of the authors.

The first of these two papers is a description of the origins, objectives, procedures, premises, and, implicitly at least, the results of GATT. Its thesis—insofar as it can be specified—holds that GATT has contributed significantly to ". . . preventing the disintegration of the movement toward freer trade . . ." and to abolition or at least to minimization of absolute import quotas and of internal programs used as protective devices. It is the opinion of the author that GATT has "become an effective instrument

for settling trade disputes, for promoting . . . rules for freer trade, and for adjusting . . . obligations . . ."; for maximizing private trading patterns and the related production patterns within irreducible limits of state trading; for reducing tariffs; for reducing quantitative barriers insofar as balance of payments and other exceptions permit; and for interpretation and settlement of disputes. There is assertion of the necessity to fit the European common market into the GATT framework by effective coordination of tariff schedules, other barriers, and overseas or colonial policies. Finally, there is a listing of pitfalls which GATT has avoided. This is a promotional paper. Taken alone, it offers no basis to appraise the validity of its conclusions.

The second paper is also straightforward advocacy. Perhaps more so even than the first, it is larded with loaded terms. There is a first-paragraph plug for this Association tied into a paper-length plug for GATT. The prevailing and presumably false notion that GATT and domestic monopoly programs are fatally inconsistent is disapproved as provocative of foreign criticism, impeding legislative approval of GATT, and as a block "when we try to put the blessing of our farm abundance to constructive use in foreign countries. . . ." This leads to two theses: (1) existing GATT provisions reconcile their apparent hostility to domestic farm policy; and (2) "greater emphasis" and "more economic analysis" of these provisions would yield "cooperation and understanding" and a "synthesis of free-world policies toward agriculture-trade problems." The first thesis is not analysed empirically nor is it really established as argument. The second one is not so stated that it could be tested at all. The author holds that "an agreement to live fairly together and keep in touch" limits the apparent inconsistency as time brings nations to appreciate the "logic and realism" of GATT. There is a brief description of administrative mechanism in GATT to determine the market shares supposedly defining "fairness." However, the permanent exceptions of GATT with respect to import quotas on agricultural commodities are noted. The author believes that subsidies which might limit or distort trade are becoming less virulent. This is the substance of the second paper. Its author then concludes that the GATT special agricultural provisions: (1) play a "useful background role in free-world efforts to meet the challenges and opportunities of our exciting times; (2) "supplement and reinforce" the free-private trade goal; and (3) really do not conflict with domestic support programs. Finally, he notes "confusion as to where governments stand on basic principles."

Certain basic facts of farm and food products trades do not seem to be considered. It is a fact that the free world is paralleled by another group of nations with which private trade is not generally possible. There are and long have been serious impediments to private trade within the free

world, and these afflict agriculture especially. Impediments are not all associated with balance-of-payment difficulties or even with autarchy. If the effects upon domestic agricultural programs of the GATT special provisions be innocuous as the authors imply, the reverse proposition certainly does not seem to be tenable. If any support program of any type in agriculture really bites—or really does anything—there will necessarily be the administrative equivalents of Section 22, Section 32, PL480 or similar programs. This is a theoretically inevitable conclusion. It is amply supported by a long history in many countries. Monopolistic domestic programs are fundamentally hostile to any private trading pattern, either domestic or otherwise. It is unfortunate that no reference was made to these facts or to their theoretical bases in either paper. These omissions engender confusion with respect to basic principles.

No economist can object to advocacy, even before a professional group. However, advocacy should be supported either by logical manipulation or by empirical testing or both. Neither test is met in either paper. Domestic agricultural programs in many countries have for many years had massive impact on trade. Merely to assert that the GATT provisions really do not limit these domestic programs is *not* to establish that these programs do not limit either GATT or trade. This latter is a relevant issue. There are all-encompassing trade restrictions on food and farm products throughout the world. What are the implications of these facts and their theoretical bases to the theses of these two papers?

CHANGES IN THE AGRICULTURAL ADJUSTMENT PROGRAM IN THE PAST 25 YEARS

O. B. Jesness
University of Minnesota

The entry of the government into active efforts to raise or support farm prices in the market place came in late 1929 in connection with operations of the Federal Farm Board under the provisions of the agricultural marketing act. This legislation followed agitation for governmental participation in price making during much of the decade of the 1920's.

The development of farm programs is an evolutionary rather than a revolutionary process. A new program does not spring suddenly into full bloom. The procedure is to draw on earlier programs or proposals, dropping out some features, adding others. Thus, the agricultural marketing act included ideas drawn from the McNary-Haugen, the export-debenture, the allotment plan and others.

The Farm Board was most unfortunate in the selection of its natal day. The members had scarcely gotten their chairs warm before the sharp break in the stock market in late October served notice of a decided turn for the worse in the economic outlook. Events forced the Farm Board into attempts at price stabilization for which it was not well prepared or equipped. Its operations consisted largely of employing its revolving fund to hold commodities, particularly wheat and cotton, in sufficient amounts to keep the prices at or near existing levels. Had the Board foreseen the severity and length of the depression, it might have been more cautious in its venture in this field. However, its members and staff apparently shared the general feeling expressed in the hopeful political slogan, "Prosperity is right around the corner." Outlook statements of the U. S. Department of Agriculture in late 1929, bolstered the hope of the Board that wheat prices might be appreciably improved by spring. Besides, the Board was hardly a free agent in deciding whether or not to enter the market, in view of the fact that the agricultural marketing act was the administration's response to the farmers' "prayers for relief."

Under more favorable conditions and with a better kit of tools, the life of the Farm Board might have been prolonged but the end result would have been the same. It passed out of existence as far as price operations were concerned with the change of administration in 1933. Its demise can hardly be described as being in a blaze of glory nor as having occassioned too much mourning. In fact, the Board was not given credit for the demonstration it provided for public edification of the absurdity of endeavoring to maintain an arbitary price without any means of curbing supplies or of disposing of accumulations. This demonstration paved the

way for the agricultural adjustment act of 1933, creating the Agricultural Adjustment Administration as an agency within the U. S. Department of Agriculture.

This act illustrates the evolutionary process. It was not, as some seem to have imagined, a case of leaders in session hammering out a completely new program. It was, instead, a case of bringing together a wide variety of ideas from earlier proposals. It drew on the experiences of the Farm Board, not only in giving emphasis to adjusting output and supplies but in price-support operations. It embodied vestiges of the earlier McNary-Haugen bills, the export debenture, the allotment, the rental and other plans. Drain on the public treasury was to be avoided by making the operations "self-financing" by means of processing taxes. The idea was an adaptation of the equalization fee of the McNary-Haugen plan, but with the assumption that the tax would be passed forward to the consumer instead of being collected from the farmer.

While "parity" was not specifically so designated in the act of 1933, the concept was outlined. This was an adaptation of a proposal embodied in the earlier forms of the McNary-Haugen bills. The Commodity Credit Corporation was established early as the operating agency. While more extensive than the operations of the Farm Board, its functions have had much in common with the earlier one.

One important addition to the act of 1933 was provisions for adjusting production in recognition of the point clearly demonstrated by the Farm Board's experience that excess supplies were depressing prices and that output had to be adjusted to make price supports effective. The emphasis has continued to be on "adjustments" rather than on "controls." The idea during the past quarter century has been that of inducing adjustments by means of incentives rather than by compelling curtailments. Criticisms are aimed at the failure to get sufficient results rather than at the public sharing in the costs of adjustment.

The Agricultural Adjustment Administration took over at or near the bottom of the depression trough when things were so bad that most any change had to be for the better. It consequently was in a position to share in the credit for improvement instead of suffering the fate of the Farm Board in being washed over the depression brink. It also received co-operation from the weather because severe drouths, especially in 1934 and 1936, helped to curtail output for the time being.

The agricultural adjustment act and its companion legislation, the national industrial recovery act, both were felled by decisions of the Supreme Court in 1936, that they were unconstitutional. The bitter criticism of the Court by the administration might have been tempered by an admission that the result was to require some drastic changes in operations which were falling short of fulfilling promises. In fact, the

administration indicated that the decision speeded changes which had been planned. A rather popular view is that the Court found the processing taxes to be unconstitutional. Had this been the case, it would have been relatively simple for Congress to appropriate replacement funds. The Court, however, cut off the program at its roots by holding that the constitution had conferred no power on the federal government to control agricultural production, hence this was a matter belonging with the individual states. The processing taxes then were invalid because they were being collected for a use which was unconstitutional.

This forced the administration and Congress to seek major replacement. The idea of inviting the states to undertake adjustment, using federal funds, was considered but found impracticable. One answer was the soil conservation and domestic allotment act of 1936 to broaden the objective of the conservation program to include improvements in farm prices and incomes, with major reliance on incentive payments to get farmers to shift acres in surplus crops to "conservation" crops. Provision also was made for payments to farmers for engaging in certain approved practices and the resulting agricultural conservation practice (ACP) payments have continued since.

The agricultural adjustment act of 1938 represented a return to a more formal price support program. It specifically named and defined "parity" and instituted price supports on "basics" on a flexible scale, from 52 to 75 per cent of parity. Hope for effecting curbs on volume for these crops was lodged in acreage allotments and marketing quotas. Most of the subsequent legislation relating to price supports have been amendments to the act of 1938; so it continues to occupy a major role. One significant change in basic thinking between 1933 and 1938 is worth noting. The act of 1933 had a section which indicated that it was intended to remain in force only during the depression. The earlier emphasis had been on recovery from depression. The act of 1938 provided price programs of a more permanent nature.

The severe drouths of 1934 and 1936, while they did not result in any general shortages, created some apprehension lest real shortages might develop. This provided a favorable climate for the unveiling by Secretary of Agriculture Henry A. Wallace of his "ever-normal granary." The problem, however, was not one resulting from "weather" surpluses occasioned by unusually favorable seasons, but one of recurring surpluses for which the ever-normal granary was not the answer. Its appeal to the public probably helped make acceptable the continuing piling up of stocks in the hands of the CCC.

By the late 1930's, accumulations of wheat and cotton were reaching levels where the term "ever-abnormal granary" was being suggested as more appropriate. An earlier observation of the late George F. Warren, in

one of his typical epigrams, was being fulfilled. He epitomized the ever-normal granary by saying "easy to fill; hard to empty." Had not World War II intervened, corrective steps would have been needed, either by reducing support levels or by imposing more effective controls. One can only speculate on what action might have been taken. Price supports then were still viewed as experimental and modification might have been more palatable politically than has been true in recent years.

War stepped up demand for many farm products so that their prices soon rose above support levels. Concern shifted from surpluses to threat of shortages and from price boosting to price and wage ceilings to contain inflation. The world was relatively well-supplied with wheat during the early years of the war. The CCC stocks, however, were consumed by using considerable quantities for livestock feed to help meet the demand for animal products and in the manufacture of industrial alcohol for synthetic rubber to offset the loss of natural rubber.

Congress changed the objective of the program from that of raising prices to farmers to that of providing incentives to farmers to produce for war needs. This involved specifying supports for a wide range of farm commodities at 90 per cent of parity. These were to remain in force until two years after the end of hostilities, presumably to give farmers a breathing spell during which to adjust to the anticipated smaller peacetime market.

Had this wartime provision been permitted to expire on December 31, 1948, supports at 52 to 75 per cent would have been restored on basics and those on some other commodities would have been dropped. Congress, however, in the act of 1948, extended the 90 per cent supports to 1950 and provided a range from 60 to 90 per cent after that. The act of 1949 extended the 90 per cent level to 1952 and narrowed the range thereafter to 75 to 90 per cent of parity. A further extension in 1952 kept the flexible provisions of 1949 from going into effect before 1954 at which time Congress authorized as an interim step a range of 82½ to 90 per cent for 1955.

Demand for farm products abetted by our aid program remained strong for several years after the war. In fact, a major share of the expansion in wheat acreage came in this period, reaching a peak of 84 million acres in 1949. Price supports continued largely as stand-bys during this period. Apparently more than a few concluded that the high level of supports accounted for the relatively favorable income position of agriculture during these years and this may have increased resistance against subsequent lowering of supports.

By 1948 and 1949 some indications of surpluses were returning and the process of rebuilding stocks was resumed. The Korean outbreak gave demand another temporary boost and this helped give the incentive levels

of support a longer life span. We showed unwillingness to face the fact that incentive supports were unsuited to a situation which called for downward adjustments, not expansion.

The Soil Bank Act of 1956 gave evidence of an awakening realization that the farm income problem could not be solved by price manipulation but that some real adjustments in capacity to produce were needed. The Administration at first viewed the proposal with considerable doubt but later seemed to find a version more to its liking. This is not the place for a detailed review of the soil bank. In brief, it has two major features, the acreage reserve and the conservation reserve. The former is intended to hold out of production for market some good land used for basic crops temporarily to bring current production below current disposals in order to move excess storage accumulations. The conservation reserve aims at longer-run removal from crop production of enough land to bring capacity to produce more nearly into balance with available markets. The incentives for farmers to put land into the soil bank are payments from public funds appropriated for that use. These are intended to replace the income which the farmer could expect to receive if he used that land for crop purposes and to cover a considerable share of the costs of converting crop land to other uses.

Some corollary programs should be noted in passing in order to round out the picture. It was realized quite early that prices supported above market levels would draw products from other countries to our markets. To head this off, Congress in 1935 added section 22 to the farm legislation, authorizing and directing the administration to restrict imports which threaten to interfere with price support operations. Import quotas or fees may be imposed on specific imports to this end. On the other hand, exports have been and are being viewed as outlets for our surpluses. Disposal of surpluses abroad at prices below those maintained at home was the core of the McNary-Haugen and export debenture plans. Authority for doing this was included in the act of 1933 and has been continued in more recent legislation. In addition, Public Law 480 and several other acts have made even more specific provision for such exports, including sales for foreign currencies, barter and donations. The initial domestic allotment and other earlier proposals were in essence two-price systems in that they contemplated sales of the domestic allotments of producers at higher prices than any production not so covered. Formal two-price proposals have been advanced. The International Wheat Agreement is, in effect, such an arangement. The Secretary has discretion to use such a program for rice, and the cotton export program dictated by act of Congress in 1956 is a two-price operation.

Section 32 of Public Law 320, seventy-fourth Congress, set aside an amount equal to 30 per cent of import duty collections for use in en-

couraging exports and for expanding domestic consumption of farm products by diverting them from normal channels of trade. The school lunch and other programs for distribution of food, while they have their nutritional aspects, owe a good deal of their origin and support to farm surpluses. A food stamp plan was in operation for a time before the war and interest in its revival is expressed from time to time.

Space and time do not permit a detailed review of all types of activities coming under the head of or related to the matter of agricultural adjustment. However, the above somewhat sketchy review is believed adequate to trace the major changes and to draw some conclusions with respect to the lessons we may have learned, or failed to learn, from these operations.

One point which stands out clearly is that prices and price relationships have held the spotlight throughout the entire period. This is not too surprising because the farmer assigns much weight to prices as a factor in his income. He views price as something almost entirely beyond his influence, and this feeling is intensified by his tendency to assume that others have greater power to fix their prices than often is the case. Attention to price hence appeals to the politician as a way to gain favor with farm voters.

The fact that farm prices tend to fall faster than prices in general when depression strikes, lends weight to the idea of "restoring" prices. What shall you restore them to? What shall be the bench mark? The idea of using a relationship between the wholesale price index and farm prices was advanced by the developers of what took shape as the McNary-Haugen bill. The Bureau of Agricultural Economics during the 1920's developed indexes of prices received and paid by farmers and employed the ratio between the two as an indicator of price relationship. Congress accepted this as a suitable basis for price supports and the idea of "parity price" was born. The identity of the person who hit on the designation of "parity" has not been established, but it is difficult to see how he could have found a term more suggestive of right and justice. The parity concept has almost attained the rank of a shrine in some agricultural circles with the result that it is difficult to get acceptance of any real objective analysis of its limitations as a price guide. The record of the past quarter of a century is that it has not been too difficult to alter the parity formula when the result was favorable to the farmer or to a given farm commodity. There has been much greater "dragging of feet" when the proposed change would have the opposite effect. Thus, "modernization" of the parity formula was highly acceptable to producers who would benefit. Others have delayed acceptance because it would operate to their disadvantage. It is easier to accept the concept of "parity" for the individual than to apply it among individuals and lines. This misses the point that

parity to be meaningful cannot be personalized but must be generalized. There was a good deal to be said for raising prices from their depression lows in 1933. However, efforts have continued to center on price ever since. The program started in 1933 at least paid lip service to the idea of "adjustment." This was the highly advertised additive which was to overcome the lack in the Farm Board endeavor. But the downward adjustment of output did not have the appeal of better prices. Folks liked the cure but not the remedy. One unforgettable lesson learned from the "slaughter of the little pigs" and the plowing under of cotton was that any program to solve surplus situations by destroying farm products is unacceptable to the public generally. Evidence also has accumulated over the years that in spite of what they may say, farmers do not view with enthusiasm production restrictions with real teeth in them. Growers of basic crops have voted for marketing quotas when they have been proclaimed, and this has been heralded as indicating acceptance of curbs. There is strong suspicion, however, that what they really have voted for is continuance of price supports and have accepted the restrictions to get the supports. One wonders whether the vote for quotas might have displayed less enthusiasm had there been a requirement that diverted acres must be kept out of use.

Past production records provide a convenient base for acreage allotments; so historical bases have been and continue to be employed. They attach rights to produce to specific farms and land. Politically and administratively the effects of this on making production adjustments among farms and regions have been largely ignored. Applied generally and rigorously, such a program would tend to freeze agricultural production in a pattern of the past. It interferes with the speed of changing to fit new technology. For example, indications are that in the case of cotton, allotments may have placed a drag on shifts to areas better suited to mechanization. The placing of a lower limit on acreage allotments appears to have been a factor in spreading the production of tobacco among more growers and shrinking the average size of this enterprise. Is it any wonder that one hears criticisms of the program as one penalizing the more efficient for the benefit of others? Capitalization of "rights" to produce into farm and land values is a natural result. The gain of this goes to the owner when he sells rather than to benefit future operators on that land. Was this the objective of Congress? Again, the conclusion seems to be that we find some of the lessions of experience difficult to absorb.

The situation since the war has not been one comparable to the depression 1930's. The picture is clear. The capacity to produce in some lines is in excess of the readiness of the market to absorb. This is due in part to a carry over of war-induced expansion, but the primary cause is advancing technology and mechanization which have stepped up agricultural pro-

ductivity remarkably since 1940. Continuation of incentive supports also has played a part. They have made it profitable to produce goods for which there is no real market home. They have priced some products out of part of their market. Replacement of United States cotton by expansion of cotton in other countries is an illustration. Another is the stimulus to synthetic fibers provided by supported cotton and wool. Wheat has been priced out of the feed market to a considerable extent. The appreciable replacement of butter by margarine certainly has not been unrelated to comparative prices affected by price supports.

We have bestirred ourselves to try to recapture the foreign market by cut-price and other sales. After we had invited other nations to take up the slack when we priced ourselves out of some of the world's cotton markets, we expressed surprise that they should take umbrage at our bargain selling. We brag about the record agricultural exports of last year while assuring other exporters that we are only being "competitive." We rush to inform the public about our record exports but speak in whispers regarding the cost to the public of achieving this record. We urge other countries to earn the needed dollars by trading and then we impose quotas on imports and engage in export dumping operations.

One lesson we apparently have been hoping we would not need to learn from our experience of the last 25 years is that there is no easy, painless or costless solution to the farm problem. We can hardly escape the inconsistency of asking the public to provide supports for continuing wheat and cotton production at such volume that even with foreign dumping at considerable cost to the public, large accumulations remain. We do our best to look the other way when someone points to the obvious line of attack—fitting capacity to produce to the available market. We may call attention to the decided cut in acres in both wheat and cotton but have a hard time ignoring the fact that acre cuts show up only modestly in output cut. We soft-pedal the fact that by not restricting other uses of acres diverted from basic crops we have expanded feed grain production with threats of burdensome meat supplies to follow. We have been spreading, rather than remedying the surplus problem.

Acre allotments and marketing quotas are suitable for temporary curtailment if effectively operated. They do not fit a situation calling for more permanent adjustment in given lines. They spread the cut over producers of the affected commodity generally and over the area generally rather than being selective. They take out minor portions of farms rather than the entire unit. The soil bank could be a more realistic adjustment device were it not so often viewed as crop insurance, a conservation program or as a means of distributing money rather than a way to buy adjustments. We have not yet accepted the need for highly selective

operation of the soil bank with the amount of adjustment bought with public money serving as the sole guide.

There is widespread unwillingness to face up to the fact that overcapacity calls for adjustment in human as well as other productive resources.[1] Disparity between farm and nonfarm incomes is cited as justification for a farm program, but without willingness to accept the idea that to the extent there is persistent disparity an important remedy is that of aiding and encouraging those who have better earning opportunities elsewhere to take advantage of them. Many rally around the flag of the "family farm" often with only the haziest notion of what they are fighting for or against.

In developing the picture of disparity, little compunction is shown over using averages of all farm people even though less than half produce nearly all of the market supply. The 60 per cent producing little or nothing for sale and consequently benefiting little, if any, from government price programs become the basis for getting such programs for the commercial producers; and then some of the people who have argued for these programs on income grounds protest that the "big fellow" is getting the lion's share.

Anyone who shows lack of enthusiasm for the price programs which have been in vogue may expect to be accused of being a devotee of the "free market." It apparently is overlooked that the market is functioning for the larger share of farm products.[2] The market is man-made and man-operated. It is not perfect. The real issue is over whether the long run gain will be greater from relying more on the market and from seeking to improve its operations than from increasing the role of government in marketing and pricing.

Some are finding it expedient to shift emphasis to the idea of providing the farmer with effective "bargaining power" to offset the power assumed to be general in other lines. It is indisputable that the individual farmer plays such a small role in the market that by himself he has no measurable bargaining strength. It does not follow, as even some economists argue, that an easy solution is for government to provide the farmer with bargaining power. It is conceivable, but rather improbable, that government could enforce such restrictions on rights to produce and sell that a considerable measure of monopoly gains in farm prices might result. However, income involves quantity as well as price. For the individual

[1] Migration from farms has been taking place during much of our history, but even with the accelerated movement of recent years it has not attained the rate needed to achieve a balance in resource use within a reasonable period.

[2] The six basics provided only 24 per cent of farmers' cash receipts from all commodities in 1956. Even when other products receiving direct supports are included, they total less than one-half.

farmer to gain appreciably from such operations, the number participating must be restricted. In other words the right to farm and entry into farming would need to be subject to drastic government restrictions if the individual farmer were to secure any important gains from monopoly. No one is heard advocating such a program. Whether such rights were tied to the land or assigned to individuals, they would soon acquire a capital value which would benefit largely the first possessor. Moreover, such a scheme would almost inevitably lead to rigidities in agriculture which would tend to make it more static instead of remaining highly dynamic.

Worship of price supports takes emphasis away from other activities which will help improve upon the agricultural situation. Farmers are the victims of various kinds of instability. Some result largely, as is true of cattle and hog cycles, from decisions of farmers themselves. Some are due to uncertainties of weather. Others result from ups and downs in the rest of the economy. Farmers have such a stake in high level stability in the economy generally that policies and programs which help promote this desirable end have an important place in the picture. These include measures to avoid inflation as well as depression.

As observed earlier, farm programs are an outgrowth of evolutionary changes rather than being the offspring of startling, revolutionary changes. But if that evolutionary process is to function in the direction of attaining improvement at a high rate, there must be greater willingness to profit from experience than has been demonstrated during the past quarter of a century. There also is call for more statesmanship and less playing of politics in dealing with the "farm problem."

Farmers have not been sharing fully in the "boom" experienced by much of the rest of the economy for the past several years. The cost-price squeeze is real, not imaginary as far as farmers are concerned. However, sympathy for the farmer does not require that one subscribe blindly to any or every farm program which may be proffered. If concern for the farmers' plight is to ripen into real improvement, more attention needs to be given to the causes and less to treating consequences. We need programs which will achieve and retain a balance between capacity to produce in different lines and the available markets.

AGRICULTURAL ADJUSTMENT RECONSIDERED: CHANGES NEEDED IN THE NEXT 25 YEARS*

MARION CLAWSON
Resources for the Future

OUR nation has had a complex and continuing program for agricultural adjustment, including agricultural price enhancement, for more than 25 years, and it has been the subject of continuing and major discussion during these years.

Under these circumstances, it is impossible for any speaker at a meeting such as this to say much, if anything, which is wholly new. I am not going to try to be novel or sensational. Everything I will say here will have been said, or at least suggested, by some speaker or writer on agriculture during the past several years. My aim will be for a balanced review of the future problems of agricultural adjustment and some suggestions for dealing with them.

The title of this paper assumes that agricultural adjustment will be a continuing problem. Events of the past two to five years, when the total economy was operating essentially at capacity and per capita incomes were rising in the nonfarm sector, while at the same time total and per capita farm income was falling, have severely shaken the faith or hope of many agricultural economists that the farm adjustment and income problem would largely work itself out under conditions of general prosperity. We seem to be entering a new postwar phase, one where agriculture is a relatively depressed industry in times of general prosperity. I say, "seem to be," because history has had a way of upsetting logical analyses of the farm situation. Should there be another war of the general pattern of the past, or should there be massive depression, the consequences for the present farm program or for any suggestions that I may make would be great. History seems to say that major deficiencies of past programs have been bailed out, once by drought and twice by war. Like the profligate who has three times been rescued by timely inheritances from kindly deceased aunts, will agriculture be rescued once again by major upheavals beyond its own confines?

It seems clear to me that this country has conclusively decided to modify the free market for agricultural commodities in the sense that it existed through the 19th century and up until about 1928. We are unwilling to let major economic and technological forces work themselves out, in terms of adjustments in agricultural production and prices, with their consequent effects upon people, in the manner of the traditional competitive market. I am not arguing that it is "good" or "bad" that we have arrived at this situation; I merely state it as my observation. Major

* The views expressed here are personal only.

government programs affecting agricultural production, prices, and income seems certain. The relevant questions are: to what purpose should these programs be directed, and by what mechanism should they operate?

Farm policy may have been or may now be inefficient in attaining the ends sought, or it may be administratively clumsy, or it may be "bad" from some other viewpoint; but it would be a definite overstatement of the case to argue that it has been or is a threat to our society or economy. Moreover, while most agricultural economists will argue that improvements are possible (even if we cannot agree entirely as to the nature of those improvements), we must recognize that merely muddling along is not an impossible alternative for a farm program. The costs of the present program are comparatively high and it is not fully satisfactory to either farmers or consumers. But a major redirection of farm programs may call for more social conflict and social change than we are prepared to face. Unless, or until, the farm situation deteriorates further, are farmers and the nation ready to face any real change?

It should also be pointed out that farm policy will come increasingly to be written by and approved by nonfarmers. In spite of a political system which gives farmers political strength far disproportionate to their numbers, the decrease in their relative numbers is rapidly reducing their political power. Even if the Farm Bloc is able to achieve or retain solidarity, its power is shrinking. Farm programs, to be acceptable, must increasingly appear fair and efficient to city people. Many past suggestions of changes in farm programs have been branded as unrealistic because farmers would not accept them. While farmer acceptance is important, perhaps it should not be viewed as all-dominant.

In the discussion which follows, I assume that we shall not have a major war, that population will continue to grow at about the present rate for the next 25 years, and that per capita incomes will continue to rise at about their past rate.

Agricultural Supply

Aggregate Response

Economists are generally familiar with the major expansion in agricultural output of recent decades. From approximately a constant area of land, and with materially fewer workers, agricultural output has about doubled since 1910. Moreover, I think it is clear that, except for a few years in each major war, output would have expanded more rapidly if larger markets and stable prices had been available throughout. The amount of capital and of current inputs into agriculture have each increased, but the major factor underlying the expansion in output has been new technology of various forms.

Let us look for a moment at the nature of supply responses in agriculture. In the short run—up to one or two years—supply responses may be either planned or unplanned. That is, weather conditions may affect total agricultural output, and to an even greater degree, output of one or a few commodities, far more than planned responses. The supply response for the commodity is most elastic, since resources can be diverted within the farm from the production of other farm commodities; for the farm firm, supply response is less elastic, but resources can be added to one farm firm by taking them from others; and for the agricultural industry the supply response is least elastic of all, since some agricultural resources cannot be quickly added to, regardless of price differentials. The elasticity increases with the length of the time period, since the longer the time period, the less are the fixed resources and the more are the variable ones. The path of expansion of output is more elastic than the path of contraction, since resources, once committed to a line of production, often have very low alternative use values. For periods up to three years, the downward elasticity of supply of all agricultural outputs is close to zero.

Technology

The foregoing relationships exhibit their simplest form in the absence of technological change. In fact, however, technology has changed so fast in American agriculture, especially in the past 20 years, as to overwhelm these static relationships. The simplest manifestation of technological advance is found in new ratios or coefficients between input and output; in the case of feed input and broiler output, for instance, the ratio has changed from about 6 pounds of feed per pound of meat 30 years ago to 3 pounds or less today. Most technological change is more complex than this. One common effect has been to greatly increase the substitutability of one resource input for another, and one commodity output for another. If crop area is restricted, by government program or otherwise, fertilizer can be substituted to a major extent; if wheat output is restricted for any reason, the resources are likely to be diverted to sorghum production. In spite of many natural barriers or limitations, in American agriculture today the areas where shifts from one input to another or from one output to another are readily possible are so great that it is not unrealistic to speak of total or generalized agricultural productive capacity.

A great many technological developments require a different complement of inputs, and particularly more capital. If a new machine is to be used, then investment must be made not only in the machine but also in annual expenditures required for its operation. The same holds true for new fertilizers, seeds of new crop varieties, new chemicals for insect control, and other new technologies. Under these circumstancs, it

is somewhat unrealistic to speak of the productivity of the capital and the technology separately; the technology cannot be adopted without the capital, and the capital finds its productive use through the new technology. It is a package deal to a large extent. This is not to say that the technology may not be capital-saving in character; the efficiency of a given amount of capital may be stepped up greatly by the new technology. In practice, most technological development in agriculture in recent years has meant a major saving in labor.

Many technological developments are such that they virtually force themselves upon the typical farmer, even when their effect upon agriculture is lowered net returns. If a new method is truly superior, the farmer who adopts it first benefits most, and the farmers who postpone adoption often lose. With a more or less fixed total labor supply, with a land area not well adapted for other production, and with other fixed commitments, the typical farmer is under considerable pressure to increase total farm output. Many new farm machines have a capacity for larger acreages than are found on many farms. I believe that the typical situation on American farms today is that the marginal costs of production are lower than the average costs. The farmer who can increase output can usually increase his net income. With the rigidity and stickiness in land ownership and land rental units which is typical of the average farm area, it is often more practical to add more machinery, apply more fertilizer, add more livestock, and otherwise intensify operations on the same area of land and with the same general farm labor force, than it is to add a marginal increment of land. Farmers have sought to do the latter, and in my judgment this is the reason for advancing land prices at a time of declining farm income. Adjustment in farm labor force is often difficult, although the rise in part-time farming shows that an increasing number of farmers are seeking to do this.

I have recently given some study to the increase in total agricultural output. The generally upward trend in output has been obscured in some degree by annual fluctuations in crop yield, largely caused by random weather variations and short-term differences in farm price relationships. If an effort is made to adjust for these, one finds a remarkably steady upward trend in total agricultural output, even for the period since 1910 and especially so for the years since 1937. In the latter period, the upward trend has been very close to 1.8 per cent annually. In my view, this is about the net effect of new technology (plus associated capital) in American agriculture. I seriously doubt if the rate of increase in output over a period of years has been or will be much affected by the parity ratio or by other measures of relative profitability. Sharply unfavorable prices may dampen the adoption of new technology and the associated increased output, but I believe they will not fully stifle it. Under forced draft of guaranteed high prices and other incentives to rapid expansion in produc-

tion, total agricultural output might rise as much as 10 to 15 per cent in three years. Under continued favorable prices, increases in output would be at more nearly the past average rate. These are obviously judgments, and unless or until we have more experience with different price ratios and modern technological change we cannot be sure what will happen. I am convinced that the underlying technological change (and its associated capital inputs) plus the internal economy of the farm far outweigh the force of short-term variations in farm prices.

Price Stability and Expectations

Uncertainty over future prices is an inhibiting factor in the minds of farmers and their creditors in considering investments and other changes to increase output. If farmers could have some guarantee against falling prices (and perhaps against variable yields), production responses would be greater. There is some indication that this has occurred for tobacco and potatoes. If it could be shown that the support prices of the past agricultural programs have operated significantly in this way, the cost of these programs might well have been more than offset by the encouragement that was given to technological change and other means of increasing output. It would be difficult to estimate with accuracy what production would have been in the absence of the farm programs of the past, but the question is crucial.

In my travels about the country during the past two years, I have asked many agricultural specialists this question: if I would guarantee now for 10 years into the future to pay full parity prices to farmers of your state (county or other area) for all commodities, with no acreage or marketing restrictions, and if machinery and other inputs were freely available, how much would output increase by the end of the 10 year period? The 10 year period was chosen to give time for short-term investments, such as supplemental irrigation systems, and for full application of presently known production techniques but not for development of major wholly new ones. The lowest estimate I have had has been 50 per cent; the highest, 300 per cent. Not too much reliance should be placed on these estimates because the persons making them had not had the opportunity for detailed study and estimate. The certainty of prices and markets would be a major factor in the increased output, in the opinion of most men. Whatever may be the precise situation, there is general agreement on the existence of a large potential productive capacity in American agriculture, far beyond our present output.

Demand

The domestic demand for agricultural commodities has also grown during recent decades. An increasing population and rising per capita levels of consumption, of at least some commodities, have increased the

over-all demand for agricultural products. Price elasticity of demand for all food is low, probably in the neighborhood of −.25; income elasticity of food is also low, perhaps in the range of .25 to .50. One would expect each to be lower in the future than in the past. With the present and prospective future level and distribution of income in the United States, the effect of further rises in per capita income upon demand for agricultural commodities will be comparatively small. Further major increases in demand will arise largely, almost solely, from increases in population. Demand for food at retail is increasingly a demand for the marketing and other services combined with the food, and this may continue to rise on a per capita basis, even though the demand for agricultural commodities at the farm or in central markets does not. Export demand for American farm commodities has not increased proportionately to domestic demand; in fact, if the demands stimulated or financed by programs of our federal government are excluded, demand for export has declined. In the world of today, most nations prefer American industrial products to American farm products; the former perhaps have technical superiority over those of other nations to a degree that the latter do not.

Balance of Demand and Supply

The future balance of agricultural output and agricultural demand in the United States depends primarily upon the respective rates of increase of agricultural technology and total population. There are other factors on the supply and demand sides of the equation, of course; but these two are dominant. The rate of population increase depends primarily upon changes in the birth rate.

The rate of future change in birth rate and in practical use of new technology are, at any given time, essentially unknowable. It is possible to marshal facts as to past changes, to make analyses as to causal factors responsible for such changes, and to form judgments as to the most probable future changes. But the latter inevitably has a large margin of error. I think we understand only dimly the causal relationships that have existed in the past. One need only study the contemporary literature to see how unprepared our best specialists were for the upsweeps in birth rate or for the continued technological advance in agriculture. We have continually been caught by surprise; I suspect we may be caught so again in the future. The fashion now is to expect a continued high birth rate, but on not much more solid evidence than that we now have one. While most professional workers are now more disposed to expect increased agricultural output from the present or a smaller level of input than they once were, we really have little solid basis of understanding what will happen and where.

Not only are these major factors highly unpredictable, but compara-

tively small differences in output or in consumption can make very great differences in the net balance. A margin of 5 per cent of current output over current consumption quickly mounts into burdensome surpluses—this is about what we have experienced in the past few years. On the other hand, a deficit of 5 per cent would probably result in greatly increased imports. An unexpectedly bountiful harvest that raised total output 5 per cent, combined with a drop in total demand of 5 to 8 per cent, could lower free or unsupported farm prices as much as 40 per cent in a single year (assuming that exports did not absorb the surplus).

My own judgment is that there will be for the next 25 years a persistent tendency for agricultural output to outrun agricultural requirements. I believe that agricultural technology will continue to advance and that this will lead to major increases in productive potential. Major new methods of research have been opening up within the past decade, and I believe they will lead to even more spectacular developments than we have seen in the past.

Future Adjustment Programs Should Consider All Productive Factors

The striking fact about past agricultural adjustment programs has been their obsession with land, as though it were the only factor of production. From the original AAA to the Soil Bank, the programs have been in terms of acreage adjustments only. No control was exercised or attempted over other factors of production, and there is little evidence that other factors were seriously considered. As a matter of fact, the Department of Agriculture's acreage adjustment programs were seriously undercut by other federal programs, some in Agriculture and some elsewhere—subsidies for the production and use of limestone and fertilizer, "conservation" payments which usually subsidized output, reclamation and drainage programs, and others. Moreover, the manner of attempting acreage adjustment has generally been that method most calculated to induce more intensive operation and greater output from the land left in cultivation. At the beginning, the adjustments were strictly in terms of a fixed percentage of each farm's area; while this restriction has been relaxed somewhat, yet the emphasis is still upon a percentage of the acreage of each farm. Naturally, the poorest land is taken out of production, fertilizer is concentrated upon the remaining area, and in other ways output per acre is stepped up. The most dramatic results have been seen in cotton. It seems clear that acreage adjustments of less than 20 per cent annually will be completely offset by increased acre yields of land left in production. Land taken out of one crop has generally wound up in other crops. Reductions in corn acreage seem to have no effect on total feed supply. The acreage adjustment programs of the past 25 years have had comparatively little effect upon total agricultural output,

especially when one considers the administrative effort and the large funds that have gone into them.

Agricultural adjustment programs of the future should consider all the productive factors. I would start with labor—that is to say, with farm people. This country has perhaps a million too many farmers today, trying to make a living there, contributing to an unneeded surplus of agricultural commodities, and at a time when there is an active demand for labor in nonagricultural employment. The avenues for transfer from agriculture to other employments are too poorly known, too expensive, or otherwise unusable by a large proportion of those who should make the transfer. Better training in rural schools, for the job opportunities which will actually exist in the future rather than for the kind of job the boy's father now holds, and better employment services to bring job opportunities to the attention of rural people would help. But these steps are wholly inadequate to meet the problem. I think we must give more direct advice and assistance to those who move from agricultural to other employment, to make the transition in working habits and in living easier. I also endorse the idea of direct cash subsidy or grant, to encourage and facilitate such transfers; some of this might take the form of wages while being retrained in formal training centers. Some farmers are too old or otherwise incapable of moving from agriculture to other employment, but the proportion is smaller than we often think it is. We have not really tried to make adjustments in farm population. Adjustments in farm labor force will not be from the poorest farms only; some of our better farmers may be much nearer the line where their earnings would be higher in nonfarm occupations. To the extent that industrialization develops in rural areas, changes in employment need not mean major changes in place of residence.

In this matter of readjustment of working force, we simply cannot let Nature take its course. The process is too slow, the cost both to those who move and to those who remain is too high, and the ultimate result is an impoverished rural community—impoverished as to rural leadership as well as financially. Part-time farming—"moonlighting"—can often be a way station on the road from farming to nonfarming, but I cannot see it as much more than that in the future. Farming is becoming increasingly more demanding as to managerial competence, and the demands for successful part-time farming may be as great as for full-time farming. To my mind, the problem of helping those who stay on the land is not less important than helping those who leave. Major reorganizations in land ownership and land tenure, in farm size, in land use and type of farming are usually necessary in areas now characterized by large excesses of farm workers. If the farm community a generation from now is to have

strong local leadership, efforts must be made now to hold some of the ablest young men and women.

The Rural Development program of the Department of Agriculture is a timid and faltering step in the direction of adjustment of labor supply to potential employment opportunity in agriculture.

A reduction in number of farms might lead to an increase or to a decrease in total farm output, depending upon how fast it was made, and on other factors. If land is transferred from a small and perhaps incompetent farmer to a larger and abler one, *and if the land continues to be used in the same general way,* gross output will rise somewhat, operating costs per unit of land and of output will fall, and the resulting income will be divided among fewer people. But if farm consolidation were accompanied by major land use changes, total output might be less, operating costs very much smaller, and income to the remaining farmers increased. It is true that 30 per cent of all farms—the smaller commercial ones—produce less than 10 per cent of total output. Some persons have reasoned from this that no possible reduction in output from the land in these farms would be significant in relation to the agricultural surplus problem. But our surplus is in the neighborhood of 4 to 5 per cent annually. The earlier comments on the substitutability of productive factors and of products and on the generalized nature of agricultural productive capacity should be recalled here. A reduction in output of the smallest farms reduces total output of agriculture, and the margin may be sufficient to eliminate the surplus.

Some adjustments in the area of land used for commercial agriculture in the next 25 years may well be necessary. The most obvious one is to stop subsidization of expansion of crop area. The most flagrant example is the federal reclamation program, where at very great cost marginal supplies of water are taken for agriculture, when some day they may be needed for industrial development in the same region to irrigate land of doubtful physical productivity in order to add unneeded land productive capacity. But payments for farm drainage, farm pond construction, and other practices may in total be as bad or worse; and the subsidized provision of technical assistance to aid in private irrigation and drainage programs is but little different. If we must have acreage adjustment programs, somehow the right hand must learn wha the left hand is doing.

The chosen acreage adjustment program should be based upon planning and action areas much larger than single farms. The whole of some farms in some localities perhaps should be shifted from crops to trees or grass, and the entire area of other farms in the same locality left in production, not some adjustment sought from each. Acreage adjustments should be highly variable by regions. My own conviction is that several

million acres now in wheat or row crop production in the Great Plains should be put into grass, but I do not think this will occur or that the land would stay in grass, as long as it is privately owned. In parts of the South, substantial areas could well be shifted from crops to trees. The magnitude of the land adjustment program and the methods used should be worked out, area by area, with some clear ultimate objective in mind, toward which specific programs should be directed.

Reconsideration of the Role of Farm Prices

Although we have, I believe, permanently abandoned the traditional free competitive market for agriculture, this does not mean that prices of farm commodities or that the pricing process are unimportant. A reconsideration of the role of farm prices in our future agricultural adjustment programs seems essential.

In a fully competitive and highly fluid economy, farm prices serve, among others, two basic purposes: 1) to guide the actions of farmers in production and the choices of consumers in consuming, both among farm commodities and as between agricultural and nonagricultural commodities and services; and 2) as part of the income allocation process. In our efforts to increase farm incomes, we have tinkered with farm prices through price supports, commodity loans, and in other ways. In so doing, we have substantially interfered with the role of prices as a guide to production and consumption. The artificial and antiquated relationships of the parity base period have carried over in large degree to the present, in spite of major changes in production techniques and costs, and of consumer preferences. How might we use the pricing mechanism to influence farm income with a minimum of interference with production and consumption choices?

In my view, we must work as rapidly as possible toward farm prices established entirely in the market place and attack the farm income problem in other ways. If prices of different farm commodities were allowed to find their competitive level, then farmers could make more rational choices (from a social viewpoint) in deciding how much of which commodities to produce. Likewise, the preferences of consumers for different commodities would find more accurate expression. The prices of many commodities are not now supported; presumably their prices would be unaffected, at least in the short run, by abolishment of price supports. The matter of appropriate grade, variety, location, and other differentials in price are much more easily dealt with in competitive than in supported markets. Prices of most commodities now supported in various ways would fall, relative to other farm commodities. It is precisely because this is so that the fight has been made by the producers of these commodities to maintain their prices.

At the same time, I would move to abolish all production control and limitations, except those whose prime purpose was smoothing out the flow of the commodity to market. I would not abolish market milk controls, since a prime purpose is, or should be, to insure an adequate supply of milk at all seasons; nor would I do away with marketing agreements for fresh fruits and vegetables, the primary purpose of which was to obtain a reasonably smooth flow of a given supply to market. Programs for the purpose of regulating rate of marketing or seasonal supply sometimes degenerate into purely price raising schemes, but absence of an artificial limitation on supply would largely take care of that danger.

In place of price supports, I would substitute income supports. By means of supplemental income payments to farmers, their incomes can be supported at any level which the rest of the society regards as fair and reasonable. This proposal has been made by others at various times in the past. But let us look at it more closely and perhaps in a new light.

Agriculture provides two basic services to our society: 1) a flow of farm commodiites, paid for currently in the market, and 2) a productive capacity, to take care of our needs now and in the future, including reserve capacity to meet emergency needs. Possibly the payments from society as a whole to farmers could advantageously be separated in two parts. Market prices could be the payment for the current flow of commodities; in addition, society might guarantee farmers a moderate return for the provision of agricultural productive capacity. In those years when total income from sales in the market place reached the agreed-upon level of farm income, there would be no supplemental payment; in those years when market prices were low, additional income payments would be made. In this respect, supplemental income payments would resemble unemployment insurance—paid only when wages failed.

A rough outline may suggest what I have in mind. Each producer would be given an output base for each commodity (of at least the 20 or so leading commodities which account for 90 per cent of total output), equal to his average output of that commodity over the past five years or so. It should be a moving base, and I would make it freely transferable, either to accompany lands transferred or separately, from farm to farm. Producers would be given supplemental income payments equal to (1) the difference, if any, between the average price of each commodity and (say) 90 per cent of the modernized parity price of that commodity, times (2) (say) 80 per cent of the individual farmer's production base in that commodity. Each producer who maintained or increased his output would be producing part of it against market prices, and that would serve to discourage increased output. The producer who was contracting his output might continue to draw supplemental income payments until his base disappeared; I would not require any production to qualify for

such payments in a particular year. The man who left farming might be allowed to take his base with him; it would, of course, then no longer attach to the land he left. Under the modernized parity formula, the free market prices would gradually establish a new relationship among commodity prices, so that in time the supplemental income payments would not be so concentrated in a few commodities, as they would be at first.

This type of supplemental payment could be used in three different types of situation: 1) when supply and demand of a commodity were temporarily out of balance, either because of unusually large output or to temporarily restricted demand; 2) in time of general depression, when maintenance of agricultural output would be a real source of strength to the nation; and 3) even on a long-term basis as a means of raising agricultural incomes in general to a new level. The last may be a dubious use, yet this would be a less offensive method than any other. The characteristics of this proposal would make it admirably adapted to deal with the first type of situation. With the present inelasticity in demand, and the probable future greater inelasticity, some means must be taken to protect farmers from extreme fluctuations in income. But the combination of a moving base, payment for only part of output, and modernized parity would operate to limit and gradually to reduce these payments. The production and consumption guidance functions of prices would be regained, while at the same time farmers would have some—but not too much—protection against variations in their incomes. To the extent that my earlier suggestions for adjustments in labor supply were followed, the need to support farm incomes would diminish. I would emphasize good farm incomes through good off-farm alternative job opportunities.

One objection raised in the past to farm income supporting payments has been their cost. The cost would depend upon the fraction of output that received such payments, upon the percentage of parity taken as a standard, and upon the production responses of farmers to the proposal as outlined here. It has been impossible for me to make detailed estimates of the costs that would be involved, upon the most reasonable assumptions as to each of these and other factors. I greatly doubt, however, that the cost of this kind of program would be greater than the costs we are now incurring for acreage adjustment, price support, storage, and other programs. The cost of a program need not be related to its form; that is, we may undertake a very costly program of any kind, or we may limit costs to a predetermined level under any form of program, depending upon our desire to pump money from the nonagricultural into the agricultural sector. Under a supplemental income program,

consumers do not pay for it twice—once as payments to farmers, and once in the market place—as they do for price support and production control payments. That is to say, a supplemental income program which had nominal costs double those of a price support program but which also had free market prices of agricultural commodities might be no more burdensome on consumers than the price support program had been. The relevant considerations for any program are how well it seems likely to achieve the criteria of production efficiency, consumption efficiency attainment of desired farm incomes, and ease of administration.

Summary

The major points of this paper can be summarized as follows:

1. Major government programs affecting agriculture are here to stay; determination of farm income by the free competitive market process for agriculture has been abandoned permanently.

2. A potential, if not actual, surplus of agricultural productive capacity will be with us for at least 25 years.

3. Acreage adjustment as a device for dealing with agricultural surplus has proved to be relatively ineffective.

4. Future programs of agricultural adjustment should be based upon all factors of production, not acreage alone, but with special emphasis upon farm people.

5. The role of prices in agricultural programs should be reconsidered, and prices used to facilitate rather than to impede adjustments.

The special and difficult problems of transition from the programs we now have to those we should have could not be considered within the time and space limits available. In any case, agreement upon where we seek to go is basic to any consideration of the best route to that destination. No direct consideration has been given to the political tactics necessary for redirection of agricultural programs. The general public seems to have learned that the agricultural problem is a perennial, that not much has been done as yet for a permanent solution, and that it is growing more costly every year. Out of this ferment may come strength enough for change.

DISCUSSION: AGRICULTURAL ADJUSTMENT RECONSIDERED

WILLIAM O. JONES
Food Research Institute, Stanford University

It should be said at the outset that in this session we are using the phrase "agricultural adjustment" as a euphemism for price-supporting and

price-raising activities of the federal government. We are ignoring such major adjustments as have been achieved by the agricultural industry without governmental assistance. I shall not quarrel with this definition of agricultural adjustment now—it does well enough for our discussion this morning—so long as we do not forget those other adjustments, much more important to both the agricultural and the national economies, that farmers and ranchers have made over the past 25 years to rapidly changing national and international markets and embodying radically new techniques of production. For this morning, at least, let us say that agricultural adjustment means direct government intervention in pricing and in production decisions. Furthermore, we are speaking almost exclusively of crops, the lesser part of agricultural output in terms of value, perhaps because "agricultural adjustment" has been most often directed at field crops, and because it is in this part of agriculture that maladjustments have been greatest.

The two excellent papers we have just heard leave the discussant very little room in which to operate. Jesness has given us an amazingly complete summary of agricultural price legislation of the past 25 years, together with a pointed analysis of its failures; Clawson has surveyed the next quarter-century with breadth and perception and has offered a specific plan for dealing with its problems. It is difficult to quarrel with their facts or with their diagnosis. Nor do I intend to. Instead, I should like to direct your attention to an apparent paradox in the remarks of both speakers, and to suggest an interpretation of it.

The analysis presented to us deals primarily with conditions for economic efficiency in agriculture. Almost nothing has been said about goals defined in terms of the welfare of farm people, the conservation of exhaustible resources, or the maintenance of national security and prosperity. The burden of both papers is that our agricultural plant is too large and that it is producing more farm products than it should. The primary responsibility for this state of affairs is laid on technological change, but the remedy for it is sought in a resort to freely determined market prices.

Jesness is most concerned over what he calls "excess capacity to produce," but I am not altogether certain that I understand precisely what he means. If "capacity to produce" means the same thing as fixed farm plant, then there is an implication that farmers always run their plants at full capacity, however defined, and that the only way to reduce output is to reduce capacity. His recommendations for changes in the adjustment program further imply that capacity of the farm plant is fixed by the amount of land in farms and by the number of farm operators.

At other points in the paper, however, Jesness clearly implies that farm output is influenced by price. He speaks of reducing support levels as an

alternative to more effective controls, and of high support prices for wheat and cotton as being responsible for the large accumulation of these commodities. Here is the suggestion that wheat production responds to changes in wheat prices in what we have come to call an "appropriate" fashion. If this is so, the burdensome surpluses exist because wheat prices are too high, a proposition with which I think Jesness might agree, although he has not said so this morning. Instead, he finds the primary cause to be "advancing technology and mechanization. . . ."

Clawson too speaks of "agricultural productive capacity" but does not equate capacity with output. On the contrary, he says that potential productive capacity is far beyond our present output, and that the typical farmer is under pressure to increase total farm output because his marginal costs are less than his average costs, i.e., his plant is operating at less than capacity. But he too places principal responsibility for increases in output since 1937 on improved technology (with associated capital), and seriously doubts if the rate of increase in output is much affected by the parity ratio.

Does he mean that output is not much affected by prices? It would seem not, because he finds that output would increase sharply if price expectations were made more certain, and he asserts that "there is a great deal of land that could be brought into regular crop production if prospective returns justified the costs." In making specific proposals for modifying federal policy, he again shows a strong faith in the ability of prices to call forth appropriate outputs.

But if the surplus production results from technological change, and not from high prices, how will it help matters if prices are freed?

In the depression years some economists made a paradox out of the fact that people moved into agriculture when farm prices fell, and there was in fact a coincidence in time. The paradox is explained, of course, when consideration is given to opportunity costs in the form of alternative employment opportunities. Jesness and Clawson have this morning given us a similarly paradoxical explanation of the excessive production of farm commodities, and it too is a paradox only because one half of the economic scissors is concealed. Farmers adopted improved methods of growing wheat and cotton and corn because they could thereby reduce the cost per unit of output. There may, it is true, be some farmers who are interested in obtaining the maximum yield of corn, or cotton, or wheat, regardless of cost, but they are probably few and they are prime candidates for bankruptcy. Despite the behavior of a few quixotic farmers who are not interested in income, all evidence confirms the economists' notion that aggregate output responds positively to price.

Why then has output risen in the face of stable or declining prices? Clawson and Jesness say because of technological change. But changing technology is not sufficient explanation. A new method is not adopted because it increases output per acre, but because it reduces costs. Farmers adopted the new methods and increased their production of some commodities because the spread between cost and price had widened, not as a result of higher prices but of lower costs. Clawson is right when he says that the party ratio is not a determinant of output: the true determinant is the cost/price ratio.

Just how effective might prices be in bringing about reductions in output and the changes in plant organization that our speakers consider desirable? Clawson has correctly pointed out that "the path of expansion of output is more elastic than the path of contraction." In a static system this asymmetry might give cause for concern; in one as dynamic as our own, in which continued rapid expansion seems likely, it is much less troublesome. High levels of employment in the nonagricultural sector make it comparatively easy for farm boys to find jobs in the cities, expanding cities continue to eat up productive farm land, and rising levels of living permit increased consumption of higher-cost foods. Creeping inflation, too, makes adjustment easier by permitting more rapid discharge of debts incurred in purchasing new capital equipment.

Both speakers advocate relying more on market prices to bring about optimum production, but each advocates specific intervention in order to spread the adjustment and specifically to move people out of farming. Jesness would aid and encourage "those who have better earning opportunities elsewhere to take advantage of them"; Clawson endorses "the idea of direct subsidy or grant, to encourage and facilitate such transfers." How can they be so sure that people ought to be led out of farming? Are they really convinced that living is better in the urban slums of New York and Chicago than in the rural slums of the south? Who is to tell the young man who is operating a quarter-section farm in eastern Nebraska that he will be happier at a desk job in Omaha because he will make more money? I should hesitate to do so.

But beyond the question of personal preferences, beyond comparison of the joys of urban and rural living, how can we be so sure that there are too many people in agriculture? If existing price-supports have produced major distortions in the agricultural industries, it is at least barely possible that they have encouraged labor-extensive farming at the expense of labor-intensive farming. If, as some people think, it would be desirable to transfer resources out of cotton and grain into specialty crops

and livestock farming, perhaps more labor would be required per unit of product.

Perhaps some persons are being held in farming by ignorance and poverty and need help; on the other hand, a good many million have left farms since 1932, at the same time that several million were moving from the cities onto farms. The statistics suggest that farm-urban mobility is very great.

A final word about the two papers before I yield the floor. Both advocate subsidies of one sort or another to farmers; neither explains why this subsidy should be paid. Both speak of a farm problem; neither says what it is. Perhaps the only farm problem today is the one of our own making and will disappear when, as Clawson foresees, farm policy comes increasingly to be written and approved by nonfarmers.

DISCUSSION: AGRICULTURAL ADJUSTMENT RECONSIDERED

K. L. ROBINSON
Cornell University

Both speakers this morning have dealt primarily with the role of government in attempting to bring about adjustments in agriculture. Jesness has concentrated mainly on so-called agricultural "adjustment" programs, which have turned out to be little more than attempts to raise or maintain the prices of certain commodities. Clawson has called attention to future adjustments that may be required. As a means of achieving these adjustments, he has suggested additional aid for education, an expanded employment service, direct financial assistance to encourage off-farm migration, the withdrawal of subsidies for drainage and irrigation as well as fertilizer and lime, and, finally, a supplemental income payments program tied to an output base calculated for each farm to replace the present system of price supports.

My comments will be directed towards two points: First, the effects of agricultural price-support programs on major farm adjustments—by which I mean changes in the size of farms, aggregate output, efficiency and the rate of movement out of agriculture; and second, the impact of such programs on intercommodity adjustments—that is, shifts from one crop to another.

The role of agricultural price-support programs in either stimulating or retarding over-all farm adjustments has, I believe, been somewhat overemphasized. My own impression, substantiated in part by the observations of Jesness, is that farm price-support programs have not altered very significantly the terms of trade of farm products over the past 25

years. Unquestionably, such programs have raised or maintained the prices of certain commodities, notably the six "basic" crops, relative to others. In addition, they probably have helped to raise or maintain the average level of farm prices for certain brief periods, but the total impact of price-support programs on the ratio of farm to nonfarm prices has been extremely modest. The major shifts in supply and demand which have been responsible for most of the changes in farm prices during the past two and a half decades have occurred independently of farm price-support programs.

I am far more impressed with how little rather than how much our so-called "adjustment" programs have accomplished. This has been due in part to the difficulty of controlling total agricultural output. Moreover, as Jesness pointed out, commodities which account for well over half the cash receipts of farms have received little if any direct benefits from support programs. Prices of some commodities may even have been adversely affected by such programs. Unquestionably there have been short-run gains to some producers, but these probably have been offset in part by lower returns to other producers and in part by reduced prices at other periods caused by the liquidation of stocks or increases in production influenced by supports in an earlier period. Since price-support programs have had such a modest effect on the average level of farm prices and incomes during the past 25 years, I find it difficult to argue convincingly that such programs have had a major impact either in stimulating or retarding over-all farm adjustments. The major adjustments which have taken place, including a high rate of movement out of agriculture, increases in the size of the typical farm business, and a very rapid rate of adoption of improved methods of production with striking effects on output and labor efficiency, have taken place more or less independently of our price-support programs.

In fact, other government programs not normally included under the term "adjustment" or price-support programs probably have had more to do with farm adjustments than those which have been discussed. Government programs relating to research, education and extension, farm cooperatives and agricultural credit unquestionably have had the effect of stimulating the adoption of yield-increasing techniques of production. These programs have in part helped to create the present farm problem by contributing to the surplus of farm workers and widening the gap between the incomes of some farmers and those of others. The accelerated rate of change in farm technology is both a consequence and a cause of government action—a consequence or by-product of some types of government programs and an argument for other types of government intervention. This aspect of the problem has been largely ignored in the papers which have been presented.

I would like to turn now to the effects of government intervention in the pricing of farm products on intercommodity adjustments. The most notable effect of government price-support programs thus far has been to alter the relative prices of farm commodities or to prevent changes in relative prices from taking place. This, in turn, has retarded intercommodity adjustments.

Clawson has called attention to the need for changing price relationships in order to redirect farm production. I am not at all sure, however, that the supplemental income payments program he proposes will have any advantages over a flexible price-support program in achieving this goal. From the standpoint of farm resource adjustment, the important part of any support program is the level of prices or incomes maintained rather than the method of making supports effective. Supplemental income payments may have advantages to consumers and possibly to some producers as a method of support; but in concentrating on the method rather than the level of support, we tend to overlook the major issue.

Producers are primarily concerned with the level of support. To the extent prices plus income payments are reduced in the future, as Clawson suggests they might be for certain commodities under his proposed program, intercommodity resource adjustments probably would take place. But viewed from the point of view of producers, a program of this type would not differ materially from a flexible support program. If income payments are to be tied to a fixed percentage of parity prices for each commodity, relative prices and incomes would change but only very slowly, provided parity prices continue to be calculated as at present on the basis of market prices prevailing during the most recent 10-year period. Ultimately, of course, market prices and hence parity prices for some commodities would fall relative to others. If this is the ultimate effect, however, why not simply alter present support prices by administrative action as the Secretary of Agriculture is now permitted to do for some commodities?

The fundamental question is whether or not we are going to use changes in relative price and incomes as the primary instrument for bringing about changes within agriculture. Adjustments in hog, beef, egg and poultry production have been achieved largely in this way. Can production adjustments in cotton, wheat, rice and a few other commodities be brought about in a similar manner? Are changes in relative prices the most "efficient" or "equitable" way of bringing about needed intercommodity adjustments? These are the questions that those concerned with formulating our future price-support programs must answer. In concentrating on the method of support, Clawson has focused attention on what I consider to be a secondary issue rather than the major one.

DISCUSSION: AGRICULTURAL ADJUSTMENT RECONSIDERED*

H. L. STEWART
Agricultural Research Service, USDA

Jesness and Clawson are to be commended for their comprehensive and provocative papers on agricultural adjustments. They have brought to bear on their analyses a vast store of experience and familiarity with American agriculture. Each has encroached slightly on the topic assigned to the other but this is both natural and desirable. Jesness' analysis of the evolution of agricultural adjustment problems and programs is made much more meaningful by his conclusions relative to the types of programs needed in the future, just as Clawson's analysis of prospective changes in agricultural adjustments and desirable programs to facilitate such adjustments is more enlightening when accompanied by his interpretations of pertinent past developments and their underlying causes. This overlapping of discussion has an added advantage for a discussant in that it reveals surprisingly similar conclusions, particularly with respect to the successes and weaknesses of past programs.

Both papers point to the conclusion that our agricultural adjustment problem is largely a resource transfer problem, a conclusion which finds considerable support throughout the literature. Clawson makes the important point that the problem of helping those who stay on the land is just as important as helping those who leave, but both papers place major stress on a pronounced and continuing propensity for agricultural production to outrun demand, and they expect this tendency to continue throughout the next 25 years. Technological progress and a relatively inelastic demand, especially for total agricultural output, are deemed to be the primary causal factors. Price depressing surpluses are said to flow from these incompatible forces. As a result, if production is to be brought into balance with demand, the need for adjustments will continue.

The ineptness of past programs to achieve and maintain a balance between production and demand is attributed to the undue dependence placed on prices and price relationships, to a reluctance to accept production restrictions with real teeth in them, and to a failure to control any of the factors of production other than land.

Both papers find the ever-normal-granary type of program ill-suited to a condition of recurring surpluses. They are critical of excessive reliance on an outmoded parity base and of undue interference with the

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* This paper expresses only the writer's personal viewpoints on the problems considered.

role of price as a guide to production and adjustments. They suggest that acreage allotments and marketing quotas tied to historical bases are suitable only for temporary curtailment and that they tend to freeze production in uneconomic patterns that impede technological progress. Jesness suggests that incentives provided by price supports have tended to accentuate adjustment problems by encouraging production for which there was no demand, and by pricing some products out of a part of their market. Clawson suggests that acreage-adjustment programs have merely encouraged a reallocation of resources within firms with increased substitution of other production factors for land, and that acreage adjustment programs have been seriously undercut by other federal programs that operate to increase production.

Clawson appears to lapse into a little wishful thinking occasionally when he suggests the possibility of agriculture being rescued by some major upheaval from outside; and, again, when he suggests "merely muddling along" as a possible alternative for a farm program. Elsewhere, however, he recognizes that there is little likelihood that technology will be stifled effectively, that there will be a persistent tendency for agricultural output to outrun requirements, and that major government programs affecting agricultural production, prices, and income seem certain. At one point he suggests also that our total surplus is in the neighborhood of only 4 or 5 per cent annually, and that a reduction in output of the smallest farms may be sufficient to eliminate a surplus of that magnitude. This hardly seems feasible since, even if we ignore the 1.5 million part-time and residential farms, the combined output of more than one-fourth of our small-scale commercial farms would be required to make up 5 per cent of our total output. Moreover, of the limited number of commodities that make up most of our surplus, relatively small quantities are produced on the smallest farms. And, if freed, pent-up productive capacity on the medium and large commercial farms doubtless would offset for some time to come any reduction that might be achieved on the small farms.

Major tenets of the solutions suggested by both Jesness and Clawson include:

1. Elimination of price supports and a return to the establishment of farm prices in the market place; and

2. A concerted effort to transfer resources out of agriculture, with particular emphasis on those who find better earning opportunities elsewhere, and on taking out entire farm units rather than mere fragments of farms.

Elimination of all production controls and limitations (except those whose prime purpose is to smooth out the flow of the commodity to the market) is another major tenet on which the papers appear to be in

agreement, although Jesness is not specific on this point. It should be noted that market milk controls and marketing agreements for fresh fruit and vegetables would be retained, and of course these include some of our most effective production controls.

The papers appear to differ relative to the desirability of some form of income supplement to augment the income to be obtained in the market place. Jesness expresses no need for such a program, but it is not clear whether this is because he sees no need for such payments or because he considers this type of suggestion outside the sphere of his assignment. He does refer to the need for highly selective operation of the soil bank with the amount of adjustment bought with public money serving as the sole guide; he warns against any possible effort to secure agricultural gains from monopoly achieved by restricting entry to farming; and he emphasizes the farmer's stake in policies and programs that help to promote high-level stability in the economy generally.

Clawson, on the other hand, sees the need for income payments to augment the income derived from sales at free market prices. He proposes a version of a fixed-share base-payment program that would provide producers with supplemental income payments based on (1) the difference between the average market price of each of a number of commodities and an established support level of each, times (2) a specified proportion of the individual farmer's production base in each commodity. The support price for each commodity would be based on a modernized parity formula, and the production base, determined on the basis of average output during the last five years or so, would be attached to the individual rather than to the land.

The income payments from society to agriculture are justified by Clawson as a moderate return for the provision of agricultural productive capacity to take care of both emergency and future needs. Should we not also justify an income transfer on the grounds of maintaining technological progress, the benefits of which tend to accrue largely to the consuming public?

I find myself in agreement with much of the foregoing appraisal of past programs, but a number of questions warrant consideration in appraising the program proposed. For example, could we not facilitate our reconsideration of agricultural adjustments if we were to take more care in defining our subject and in delineating its component parts? Are we addressing ourselves only to the problem of adjusting agricultural production to demand, or are we including the problem of maintaining producers' incomes during the period of adjustment? What level of incomes are we shooting for—one that will provide a return to resources comparable to that obtainable in other sectors of the economy or one that will prompt a transfer of resources out of agriculture? Does our problem

include the scope of resource reallocation required to solve the income problems of the 3.5 million "farmers" with incomes of less than $5000? Clawson appears to imply that it does when he criticizes the Rural Development Program as a timid and faltering step in the direction of adjustment of labor supply to potential employment opportunity in agriculture. Jesness apparently addresses himself to the larger, commercial producers. But whether or not we include the problems of the underdeveloped rural areas around which the Rural Development Program was developed, as well as the problem of adjusting production to demand, recognition of the differences between these problems, of the magnitude of each, and of the fact that they require different solutions should help us avoid some pitfalls in our search for solutions.

Here it seems appropriate to say parenthetically that we do need more information about the nature and the problems of the various pertinent segments of our agriculture in order to understand the magnitude of their several problems. For example, Clawson indicates that the proportion of our farmers who are too old or otherwise incapable of moving from agriculture to other employment is smaller than we often think it is. But I'm inclined to believe, and we're beginning to accumulate some fragmentary substantiating evidence, that a substantial portion of our "farmers" are too old or otherwise incapable or uninterested either in moving or in making any significant adjustments in their farming operations in order to improve their income. This was touched on in one of the earlier panel discussions.

Another question pertains to the timing required to control production by transferring resources out of agriculture. It has been demonstrated repeatedly that removal of fragments of the land resource does not control production. Could not removal of portions of the human resources meet with similar results? In fact, is it not likely that removal of our small, inefficient farmers would actually result in an increase in output as the resources vacated were taken over by more efficient producers as a part of their larger, more efficient operating units? Clawson makes a point here when he indicates that a reduction in number of farms might lead to either an increase or a decrease in total farm output, depending upon the speed with which it is made. In my opinion, we cannot move people out of agriculture in a voluntary type of program compatible with our American way of doing things, fast enough to bring production into balance with demand, without some type of production-control program. Clawson's suggestion of an income supplement to augment market prices would appear to support this opinion; yet he also suggests the abandonment of all production controls.

A related question pertains to the effectiveness of the suggested fixed-share base-payment type of program without some type of production

control. Will such a plan provide producers with adequate incentive to reduce production? Under a plan of this kind the marginal units of production receive only the market price. But the return for such units has only to exceed the variable costs in order to encourage maintenance of their production.

If some type of control proves to be necessary, could not some of the disadvantages attributed to the acreage allotments and marketing quotas of recent programs be avoided by using quantity allotments rather than acreage allotments, and by making them transferable? Would not quantity allotments alleviate the incentive to substitute capital for land? And would not transferable allotments alleviate the danger of freezing production in uneconomic patterns that retard technological progress? The transfer of tax-exemption certificates as permitted under the old Bankhead Cotton Act of 1934 represents a precedent for this type of program from which adaptations might be made to current needs.

Others have suggested that a program of the type suggested by Clawson might be operated on a premium and penalty basis, with a part of the funds required for income payments obtained by assessing penalties on marketings in excess of quantity allotments. Could not such penalties be used effectively to discourage excess production? Producers of basic crops have become accustomed to penalties on excess production and, as Jesness points out, the development of our farm programs is an evolutionary process in which we strive to improve on earlier programs.

One wonders too, whether a well-conceived conservation-reserve type of program should not play a part in our adjustment programs by providing an alternative use for land. Jesness implies that it probably should. Clawson is not specific on this point. But certainly the Soil Bank "bid procedure" announced recently on a four-state trial basis offers a means of blocking out entire areas to be shifted to grass or trees, as he and others have suggested.

Although it may be beyond the scope of our assignment, it may be in order to conclude this discussion with another brief look at the conclusions in light of the agricultural adjustments that may be required beyond the next 25 years. Neither of the papers under discussion makes a point of doing this, and rightly so in view of the assignment. But as some of the leading members of our profession are beginning to express a concern about the ability of the United States to meet the demand for agricultural products in the period beyond the next 20 to 25 years, any reconsideration of agricultural adjustments that does not recognize this position would appear to be amiss.

This pessimistic position seems to me to be unwarranted on the grounds that technological progress will assure our ability to meet the demand for agricultural products long beyond the 25-year period under discussion

here. Technology, fostered by research, has been the key force in the achievement of our ever increasing standard of living and it is inconceivable that we would even attempt to stifle it. I believe that our capacity to produce can be expanded greatly. I infer that Clawson would agree. But even in the event of a tighter food supply than many of us anticipate, the adjustments suggested above, with emphasis on getting resources out of agriculture in order to bring production in line with demand, may not be incompatible with those that would be desirable. The transfer of people out of agriculture and the formation of larger, more efficient family farms should result in a sound, efficient agriculture, more responsive to price and more capable of maximizing output than is our current agricultural plant.

IMPLICATIONS OF RECENT RESEARCH ON OPTIMAL STORAGE RULES[1]

ROBERT L. GUSTAFSON
University of Chicago

FIRST, it should be mentioned that use of the term storage "rules" is not meant to imply necessarily a prejudgment in favor of governmental control of storage levels. The term is defined independently of a specific institutional framework, and may be thought of, depending on the context, either as a prescription for a government agency's behavior, or as a description of market behavior, or as a standard for evaluating storers' behavior, whoever the storers may be.

Since there is little point in discussing "implications" without being clear about what the implications are based on, I shall summarize the main ideas about what is meant here by "optimal" storage rules, and how they may be derived.[2]

The storage "problem" may be stated as follows. At the beginning of a given crop-marketing period, we know the amount of carry-over from the preceding period and can estimate fairly accurately the amount of harvest or output in the current period. The sum of these amounts, which I call the "supply," is the quantity available for utilization and carry-over in the given period. The problem is to determine what the carry-over should be at the end of the given period. The quantity utilized will, of course, be simultaneously determined, as will the amount added to (or subtracted from) storage.

A storage "rule," as the term is used here, is a function which states the relationship between the carry-over at the end of the period and the total supply available during the period, as well as perhaps other observable variables.[3] A storage policy of n periods is defined as a set of storage

[1] These comments are based on research most of which was carried out under a contract between the University of Chicago and the U.S. Department of Agriculture. Needless to say, nobody except the writer is responsible for any errors, or, in particular, for any opinions or conclusions expressed here. Most of the discussion will be on feed-grain storage, with brief allusions to some of the results of the more recent work done on pork storage.

[2] These matters are discussed in full detail, particularly with respect to computational procedures, in a forthcoming publication in the U.S. Department of Agriculture Technical Bulletin series by Gustafson, R. L., "Carry-over Levels for Grains: A Method For Determining Amounts That Are Optimal Under Specified Conditions," U. S. Department of Agriculture Technical Bulletin No. 1178 (in press).

[3] Carry-over is optimally a function of supply alone, provided that future fluctuations in output are treated as random. To the extent that such fluctuations are predictable on the basis of currently observed variables, the optimal carry-over becomes a function also of such variables. For grains, the rules which we have computed have been mostly of the simple type making carry-over a function of supply alone. However in the case of pork, there is evidence that this is an oversimplification, and the rules there are made dependent also on other, observable "prediction" variables.

rules for those periods. The storage problem, then, may be stated as that of finding an "optimal" policy or optimal set of rules, given the relevant conditions, and given the criterion of optimality or policy decision about goals to be achieved.

In practice, we may be primarily interested only in what should be done in the current period, but the decision as to how much of an available supply should be used in the current period and how much should be carried over for use in future periods must depend on how the quantity carried over is to be distributed among those future periods. It is essentially for this reason that storage policy, to be demonstrably optimal, must be defined and derived in terms of storage rules, rather than simply in terms of recommended specified "levels" of storage.

This does not imply, of course, that one must compute storage rules for all future periods, *ad infinitum*. What happens in future periods becomes of lesser importance (i.e., has less effect on the optimal rule in the current period) as the computations are carried further into the future, so that, with a finite number of operations (or iterations), the optimal rule for the current period can be determined to any desired degree of accuracy. In the applications to feed grains, the marketing period was taken as a year, and the number of iterations required to achieve "convergence" in the computations varied between five and 15. In other words, the effective "time horizon" for these applications may be said to be somewhere between about five and about 15 years, depending on the conditions and criterion for which the rule is being determined.

Under the assumption of "stationarity," i.e., that all relevant conditions and criteria are the same in each year, the optimal storage rule is also the same in each year. All the applications to feed grains which have been carried out have assumed, for computational purposes, stationarity in this sense. The assumption is not, however, as restrictive in its effects as it might at first appear.[4]

The conditions which are relevant to the determination of storage rules are four: the interest rate, the cost of storage, the probability distributions of output in future periods, and what I call the "total social value function," i.e., a function which relates the total value to society of utilizing alternative quantities in a given year *to* the respective quantities.

The objective determination of a social value (or social utility) function is, of course, fraught with problems, and a completely rigorous or definitive determination is probably impossible. Nevertheless, *any* storage policy necessarily assumes, implicitly or explicitly, some value function,

[4] For example, nonstationarities introduced by lag effects in demand or supply can in some cases be allowed for approximately by making certain "equivalence" adjustments in the parameters used in the computations. Also, future trends in production or demand, if known, can readily be allowed for.

and it is clear that explicitness in assumptions is generally more conducive to rationality than is absence of explicitness.

Perhaps the most practicable way of objectively approximating a total social value function is to let the *marginal* social value of a given quantity be equal to market price, in a market price-quantity (or inverse demand) relation suitably specified. In particular, the demand elasticity used should be for the "short run" (since we are concerned with year-to-year changes in quantities), and it should be defined with the real productive capacity of the economy held constant, except for changes in the production of the given commodity.

In any case, however the social value function is determined or decided on, the criterion of optimality may then be defined as follows. First, the "gain" in any year resulting from storage is defined as the total social value of grain utilized under the storage program minus the cost of storage minus the total social value of grain that would have been utilized in the absence of any storage. It can readily be seen that the probability distribution of gain in any year depends on the probability distribution of output, the storage rule applicable in that year, and the carry-in, which in turn depends on the storage rule applicable in the preceding year, the distribution of output in that year, and so on back to the initial year. An optimal storage policy, then, is defined as the set of storage rules which maximizes the sum of discounted expected gains for a given number of years, or, in the case of stationarity, for all future years.

The "solution," i.e., the mathematical derivation of storage rules which can be shown to satisfy uniquely the stated criterion, is adapted from the Dvoretzky, Kiefer, Wolfowitz solution of the inventory problem for a firm,[5] and the computational method used to calculate specific rules under stated conditions is an iterative one based directly on that solution. It can be shown that, if the total social value function is differentiable, an equivalent solution and equivalent computations can be carried out using the marginal social value function. Use of the latter function has several advantages which I shall not detail here.

In particular, however, it can be shown that, in the case of stationarity, the storage rule which maximizes the sum of discounted expected gains in all future years is the unique function θ which satisfies the following equation for all values of C:

$$\alpha \int_0^\infty \rho[C + x - \theta(C + x)]dF(x) - \gamma'(C) = \rho[\theta^{-1}(C) - C],$$

where α is the "discount factor" (equal to $1/(1 + \text{interest rate})$), ρ is the marginal social value function, C is carry-over, x is output, F(x) is the

[5] Dvoretzky, A., J. Kiefer, and J. Wolfowitz, "The Inventory Problem: I Case of Known Distributions of Demand," *Econometrica*, 1952, Vol. 20, pp. 187-222.

probability distribution of x, and γ' is the marginal cost of storage function.

Two "implications" can be seen from the above equation:

1) The first is that the aggregate amounts that would be stored by private firms maximizing expected net revenues in a competitive market are identical to the amounts that would be stored by a government agency maximizing the sum of discounted expected social gains, provided that

a) the marginal social value function is defined as the market price-quantity relation;
b) the marginal cost of storage to a government agency, for a given quantity, is the same as it is to a private storer (when all private storers are in equilibrium, with the same given aggregate quantity);
c) either the relevant conditions are stationary from year to year, or, if not, then the relevant information available to, and acted on, by private storers, is the same as that available to and acted on by a government agency.

2) The second is that, for the case where the government operates the storage program directly, if again the marginal social value function is the same as the market price function, and if the marginal cost of storage is constant, then the expected cost to the government of operating an optimal program is zero.

We have computed optimal storage rules for aggregate feed grains in the United States under a variety of alternative sets of conditions.[6] The data were used, and the computations carried out, on a per-acre basis, so the results can be applied to different levels of aggregate acreage.[7] All of the per-acre quantities and values used here can be translated into approximate national aggregates by multiplying by 140 million acres.

The probability distribution of yields was estimated from records of the actual variability of yields in the period 1901-1950, with an adjustment for trend. The resulting empirical distribution is fairly highly negatively skewed, and has the following other properties: mean, 29.5 bu.; range, 16 bu. (19 minimum to 35 maximum); variance, 9.18; standard deviation, 3.03 bu.[8]

For the purpose of discussing implications, I shall use here only two

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[6] The actual aggregate used was corn, oats and barley, converted to corn equivalents on the basis of pounds of digestible nutrients per bushel. Sorghums were omitted because of lack of certain relevant data.

[7] In the results which I shall use here, no account is taken directly of fluctuations in acreage, although it should be mentioned that such fluctuations, whether predictable or random, can be incorporated into a more general computation.

[8] For the years 1946-1955, the actual U.S. average yield, for our "corn equivalents" aggregate, was 30.9 bushels per acre. The computed rules can easily be adjusted for such changes in "normal" yield. It can also be shown that the computed rules are not sensitive to errors in the estimate of yield variance which might be introduced, for example, by sampling variability, provided the estimates of the other conditions used are "realistic."

of the rules which have been computed, and label them "Rule 1" and "Rule 2" respectively. The sets of conditions used are summarized as follows:

Rule:	Rule 1	Rule 2
(Constant) Marginal cost of storage ($ per bu.):	0.10	0.04
Interest rate:	5 per cent	2 per cent
Elasticity of quantity used with respect to marginal social value:	−0.50	−0.30

The parameter values used for computing Rule 1 are approximate estimates of what are taken to be the relevant actual existing values.[9] The parameter values for computing Rule 2 are chosen to indicate the nature of the assumptions that would be required to "justify" relatively high levels of storage.

The marginal cost of storage in each case was taken as constant, i.e., in particular, we have, for simplicity, excluded from consideration the concept of the "convenience yield" of stocks.[10] The carry-over levels here are therefore exclusive of what might be called working stocks, which are of course not constant, but probably average roughly about 1.4 bushels per acre or 200 million bushels in aggregate.

The computed rules are tabulated and illustrated below.[11]

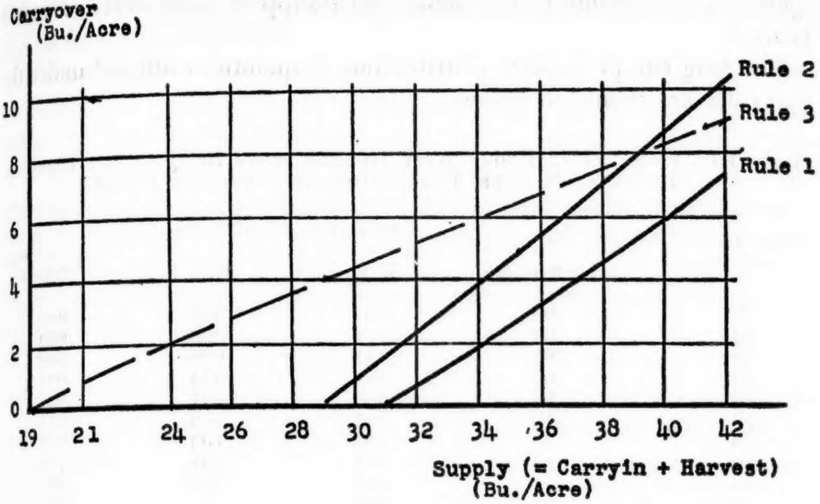
Once a rule has been determined, then probability distributions that would occur as a result of application of the rule can be computed for each of the relevant variables—supply, carry-over, quantity consumed, and price—for any given year, as a function of the level of carry-in. Then, by iteration, the "long run," "stable," or "convergent" probability distributions of all the variables can be obtained.

Supply (bu./acre)	Carry-over (bu./acre)		Supply (bu./acre)	Carry-over (bu./acre)	
	Rule 1	Rule 2		Rule 1	Rule 2
Less than 29	0	0	38	4.44	7.01
29	0	0.07	40	5.89	8.66
30	0	0.77	42	7.38	10.34
31	0	1.50	44	8.89	12.08
32	0.55	2.25	46	10.45	13.83
34	1.74	3.80	48	12.02	15.61
36	3.05	5.40	50	13.63	17.42

[9] I.e., if I were required to choose a "realistic" optimal storage rule for feed grains, I would say Rule 1 is close to it.

[10] See Telsor, L. G., "The Supply of Stocks: Cotton and Wheat," Ph.D. dissertation, University of Chicago, 1956.

[11] It may be noted that Rules 1 and 2 have the same general shape (slightly concave upward) and roughly the same slopes, differing mainly in "level." (These general relationships held approximately for all the optimal rules computed.) Rule 3 is a *non*-optimal storage rule which will be introduced later, for comparative purposes.



I shall summarize here only the long run distributions of carry-over and quantity used, to convey some idea of the "operating characteristics" of the two rules being compared.

From the Long Run Probability Distributions of Carry-over Level:

Under Rule 1:

Average carry-over: 0.33 bu./acre (about 47 million bu. aggregate)
Relative frequency of zero carry-over: 73 per cent
"Upper limit" carry-over (exceeded with probability 0.1 per cent): 3.0 bu./acre (about 420 million bu. aggregate)

Under Rule 2:

Average carry-over: 3.14 bu./acre (about 440 million bu. aggregate)
Relative frequency of zero carry-overs: 16.3 per cent
"Upper limit" carry-over (exceeded with probability 0.2 per cent): 10.0 bu./acre (about 1400 million bu. aggregate)

The "implications" of these results depend somewhat, perhaps, on one's point of view. However, I think three comments are worth making:

1) Under "realistic" assumptions about relevant conditions (Rule 1), optimal carry-over levels are remarkably low, being zero most of the time, and essentially never getting above about 400 million bushels.

2) Comparing the results under Rules 1 and 2, we may say that the determination of optimal carry-over levels is at least moderately sensitive to the values of the parameters of the conditions assumed, arguing for the importance, in any practical application of storage policy, of obtaining estimates of the conditions which are as accurate and as relevant as possible. But

3) It requires highly "unrealistic" assumptions about relevant conditions, such as those of Rule 2, to "justify" levels of carry-over which

approach in magnitude the actual price-support carry-overs of recent years.[12]

The long run probability distributions of quantities utilized under the two rules are tabulated below.

LONG-RUN CUMULATIVE PROBABILITY DISTRIBUTIONS OF QUANTITY UTILIZED (BUSHELS PER ACRE) UNDER DIFFERENT STORAGE RULES

Quantity Utilized	Cumulative Frequencies			
	No Storage	Rule 1	Rule 2	Rule 3
18	.00	.000	.000	.000
19	.02	.015	.003	.000
20	.04	.034	.008	.000
22	.06	.054	.024	.004
24	.06	.060	.041	.042
26	.10	.094	.060	.074
28	.22	.200	.103	.217
30	.64	.574	.798	.703
32	.88	.974	1.000	.973
33	.98	1.000		.998
34	.98			1.000
35	1.00			
Variance	9.18	7.60	3.51	3.93
Std. dev.	3.03	2.75	1.87	1.98
Long-run average carry-over	0	0.33	3.14	6.98

It will be noted that neither Rule 1 nor Rule 2 reduces the long run probability of occurrence of low levels of utilization by very much.[13] The "implication" here is that, under the criterion adopted and the estimates of conditions used, it is simply not economically worthwhile to reduce such probabilities by very much, especially if the estimates of conditions are fairly "realistic."

Rule 3, referred to in the table, is introduced here for comparative purposes. It is a *non*-optimal rule which is chosen to achieve the purpose (if such be a purpose) of reducing the probability of occurrence of low levels of utilization. It is a "proportional" or "linear" rule, specifically, $C = \theta_3(S) = 0.4(S - 19)$. (The reasons for the choice of the coefficient 0.4 I omit here.) It may be noted that although Rule 3 does reduce the probability of low levels of utilization, it does so only at considerable cost: the long run average level of carry-over is about 7.0 bushels per acre, as compared with 0.3 under Rule 1 and 3.1 under Rule 2. Also, the

[12] The current level of Commodity Credit Corporation stocks of "corn equivalents" of corn, oats and barley is about 1300 million bushels.

[13] For example, the probability that quantity utilized in any year will fall to or below 22 bushels per acre (or about 37.5 per cent below normal) is about 6 per cent with no storage, about 5.4 per cent under Rule 1, and about 2.4 per cent even under Rule 2.

reduction in the variance of quantity utilized is actually slightly less under Rule 3 than under Rule 2.

I turn now to a brief consideration of "costs and benefits" that can be expected to accrue from the application of optimal storage rules. First, define the "expected returns to storage" as the maximized sum of discounted expected gains from storage, where the "gain" in each year is the total social value of quantity utilized under the storage program minus the cost of storage minus total social value in the absence of storage. Then the expected returns, as a function of the initial year's supply, can be computed and are tabulated below for the two optimal rules we are considering.

EXPECTED RETURNS TO STORAGE (DOLLARS PER ACRE) UNDER RULE 1 AND RULE 2 FOR VARIOUS INITIAL LEVELS OF SUPPLY (BUSHELS PER ACRE)[14]

Supply	Rule 1	Rule 2
Less than 30	$ 0.32	$11.41
30	0.32	11.48
32	0.35	11.97
34	0.58	12.97
36	0.95	14.50
38	1.80	16.57
40	2.83	19.08
42	4.16	21.58
44	5.79	23.98
46	7.67	26.30
48	9.52	28.54
50	11.28	30.71

The magnitudes involved here, when converted to national aggregates, are fairly substantial—at least enough so to make research effort on storage policy seem somewhat worthwhile. On the other hand, if compared with the discounted present value of all future grain grown per acre (roughly about $900 for the interest rate of Rule 1 and about $2250 for Rule 2), it is clear that the relative contribution which a storage policy can make to real income is small.

It is of some interest to consider how the effects of a storage policy are distributed among relevant groups. I shall consider three such categories, "producers" of the grain, "users" of the grain, and "storers." Probability distributions of gains and/or losses to each category can be com-

[14] The higher values occurring under Rule 2 do not mean, of course, that Rule 2 is "better" than Rule 1—each rule maximizes the returns under the conditions assumed in computing it; the higher returns of Rule 2 are due to having assumed conditions which would make storage more valuable to the economy than it is under the conditions of Rule 1. (Similarly, each rule maximizes the returns for every possible level of initial supply, so the fact that the returns increase as initial supply increases simply reflects the obvious fact that storage becomes more valuable.)

puted, for a given year for alternative levels of carry-in, and then, by iteration to convergence, for the long run. I shall give here only long run *average* "first order" results for one from among many possible sets of comparisons.[15]

LONG RUN AVERAGE "FIRST ORDER" COSTS AND BENEFITS UNDER DIFFERENT STORAGE RULES[16]

	Rule 1	Rule 2	Rule 3
Assumed Conditions			
Marginal cost of storage ($/bu.)	0.10	0.04	0.04
Interest rate	5%	2%	2%
Elasticity of demand w.r.t. market price	−0.50	−0.50	−0.50
Elasticity of quantity used w.r.t. marginal social value	−0.50	−0.30	−0.30
*Long Run Annual Averages ($ per acre)****			
*(1) Cost of storage	0.033	0.126	0.279
*(2) Interest cost	0.026	0.097	0.216
*(3) (1)+(2)	0.059	0.223	0.495
*(4) Gain in Total Social Value of Grain Used	0.077	0.451	0.424
*(5) Social Gain from Storage: (5)−(3)	0.018	0.228	−0.071
**(6) Producers' Monetary Gain	0.099	0.476	0.371
*(6a) Producers' Gain if they bear storage cost: (6)−(3)	0.040	0.253	−0.124
**(7) Users' Monetary Loss	0.158	0.567	0.515
*(7a) Users' Loss if they receive all the gain in total social value: (7)−(4)	0.082	0.116	0.091
**(8) Storers' Monetary Gain on Purchases & Sales	0.059	0.091	0.144
*(8a) Storers' Gain if they bear cost of storage: (8)−(3)	0.000	−0.132	−0.351

*** As compared with zero storage.
** Items which are directly comparable for all three rules.
* Items which are directly comparable only for Rules 2 and 3.

Again we note that the magnitudes are small relative to the total value of grain produced, but not negligible in absolute amount, on a national aggregate basis. For example, under Rule 2, the storage agency could

[15] It should be mentioned that, again, values occurring under Rule 1 are not directly comparable for some items with those of Rule 2, because the two rules are determined for different sets of conditions. However, Rule 2 and the non-optimal Rule 3 are assumed to be comparable in all cases.

It should also be emphasized that the comparisons are meant to be suggestive only, since (a) in large part, "producing," "using," and "storing" are done on the same farms; and (b) by considering only "first order" effects, we abstract from the fact that any significant changes in the effects on producers and users would in the long run tend to be offset by shifts of other resources. It is for these reasons, among others, that the concept of "social" gain, uncongenial though it may be, in some respects, is felt to be the relevant one for determination of optimality.

lose on the average about 18 million dollars a year, despite the extremely low assumptions about cost of storage and the interest rate.[16]

What *general* conclusions pertaining to implications for over-all policy, if any, can be drawn from all these computational results? My own general conclusion, and here perhaps I should emphasize that there is some element of opinion as well as of fact involved, is that probably the best recommendation one could make, as an economist, to the public, would be that the government should get out of grain storing activity entirely. There are three steps or sub-conclusions involved in arriving at this general conclusion:

First, there is a fairly strong theoretical presumption that in a free market private storers will, in aggregate, store amounts that are approximately socially optimal, by the criterion used here.[17]

Second, our computations indicate that, to the extent to which a free-market storage policy might not be optimal, the improvements, in terms of the relative increases in real income to relevant sectors of the economy, which could be effected even by a perfectly optimally operated government storage program are not very great. In other words, storage of feed grains does not appear to be the kind of economic activity where substantial gains can be obtained through governmental intervention.[18,19]

Third, there is ample historical evidence, especially over the last

[16] Also, note that Rule 3 is not only non-optimal, but actually worse (from the standpoint of social gain) than no storage at all.

[17] This presumption is, of course, conceptually subject to empirical test. Unfortunately, there have been only a relatively few years in the past in which a free market existed *and* in which adequate data on carry-overs of feed grains are available.

I have, however, made some attempt to test the presumption in connection with the study of pork storage. There we are primarily interested in seasonal rather than inter-year storage, and the evidence indicates that

a) on the long run average, i.e., over a period of several years' duration, seasonal levels of pork inventories held by private storers are in aggregate about optimal, in the sense of equating the average seasonal price change to the cost of storage, including a "normal" return on investment; but that

b) the *non*-optimalities in particular years are sometimes very great. The evidence also suggests that the non-optimalities are probably largely due to lack of adequate information, on the part of storers, about the extent to which year-to-year changes in the seasonal pattern of production are in fact predictable.

[18] This does not mean, of course, that if the government is engaged in and continues to engage in storage activity, we should ignore the question of optimality of the policy followed. It is clear that non-optimal policies can result in very high losses indeed, in terms of absolute national aggregates.

[19] Both the first and second steps or sub-conclusions are, of course, based on the judgment that the marginal social value function *can* best be approximated by the market price-quantity relation, suitably specified. If this judgment is rejected, then neither conclusion holds. For example, if total social value is set equal to total revenue of grain producers, with the same storage cost and interest rate conditions of our Rule 1, the resulting optimal storage rule would give carry-over levels even higher than those of Rule 2.

10 years or so, that once the government becomes engaged in storage activity, there are very strong political pressures to make the policy followed increasingly non-optimal.

I do not mean to suggest, of course, that I think the Commodity Credit Corporation should immediately release all its currently held stocks. One of the important potential practical applications of computed storage rules would be in serving as a guide to the rate at which stocks could be brought down from their current levels. Although I have, largely for simplicity, somewhat emphasized in the present discussion the long run effects of applying optimal rules as defined here, one of their important properties is that they are derived and computed, not only to result in "desirable" long run averages, but also so as to be optimal, under the criterion specified, when applied starting in any given year with *any* given level of initial stocks or initial supply.

Current CCC stocks of corn, oats and barley, in corn equivalents, are about 1300 million bushels, or about 9.4 bushels per acre. If our Rule 1, for example, were to be applied starting this year (with a minor modification to adjust it for the current estimate of normal yields), it would take about four years to reduce stocks to their long run average level under the rule, i.e., about 50 million bushels, assuming normal yields each year. The period could, of course, be shorter or much longer, depending on what happens to yields; but in any case application of the rule each year would be optimal, in the sense of maximizing the sum of discounted expected gains, whatever the particular year's level of carry-in or production might be.[20]

Finally, the conclusion or opinion that the government should not store grain at all should be modified somewhat to allow for the possible desirability of reserve stocks held in case of occurrence of war or other national disaster. Optimal rules can be derived which include allowance for such contingencies, if one can make estimates of their effects on the relevant conditions of demand and supply, and can make assumptions about the probabilities of their occurring. Such rules can be expected to have about the same form, except for level, as rules calculated for corresponding conditions except for excluding the disaster contingency elements. The difference in levels, then would be the "optimal" "disaster reserve" stock.

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[20] The corresponding period, if Rule 2 were applied, would be about 12 years to reduce stocks to about 500 million bushels, assuming normal yields.

DISTRIBUTED LAGS AND ESTIMATION OF LONG-RUN SUPPLY AND DEMAND ELASTICITIES: THEORETICAL CONSIDERATIONS

MARC NERLOVE*
*U. S. Agricultural Marketing Service***

Introduction and Summary

THIS paper is devoted to defense of the proposition that it is impossible to measure *the* short-run elasticity of supply or demand, and that only under special conditions is it possible to measure the long-run elasticity "directly." Although, by assumption, I neglect entirely the problem of simultaneous determination of relevant variables, I show that statistical regressions among quantity, price, and/or other relevant variables do not always yield economically meaningful relationships. The difficulty thus encountered is closely related to the concept of a distributed lag. Suitable dynamic models of consumer or producer behavior have been shown to lead to distributed lags; these models may be used to obtain estimates of long-run elasticities without explicit introduction of distributed lags. A large number of statistical analysis based on such dynamic models are nearing completion. Such results as are now available appear promising: When analyses based on dynamic models are contrasted with those based on the more traditional static approach, we find that the former analyses explain the data better, that the coefficients are more reasonable in sign and magnitude, and that the calculated residuals indicate a lesser degree of serial correlation. This paper gives theoretical reasons why this should be so. I hope to present statistical results in the near future.

Short-Run Elasticities, Long-Run Elasticities, and Expectations

The distinction between the short and the long run is frequently used in a loose way. Let me, therefore, mention briefly those elements which are important to the argument.

On the supply side. The usual distinction between long-run and short-run elasticities of supply has generally been made on the basis of an assumption about the supply of certain factors to the firm or industry. The contention is that in the shortest of all short runs most or all factors of production are fixed while, as time passes, successively more of these restrictions are removed. Under this interpretation of the meaning of different

* I am indebted to R. J. Foote, U.S. Agricultural Marketing Service, for helpful comments.

** On military leave.

runs, it can be shown that the short-run elasticities of supply for an individual firm are always less than or equal to the long-run elasticity and that the longer the time or "run" allowed for adjustment, the closer is the short-run elasticity to the long-run.[1] Thus, from any point on a long-run supply schedule we may think of a fan of short-run supply curves which gradually approach the long-run curve, from the left above it and from the right below it.

On the demand side. The economic theory of the individual consumer or family unit is similar to the theory of the individual firm: a firm maximizes profits subject to various restraints and a consumer maximizes satisfaction or utility subject to restraints. Just as a firm produces a product with fixed as well as variable factors, so a consumer produces satisfaction with stocks of durable or semi-durable goods as well as with goods of a more perishable nature. Because stocks of durable or semi-durable goods have greater elasticities of supply in the long than in the short run, the elasticity of demand, even for a perishable commodity, is greater in the long than in the short run.

Uncertainty. The usual distinction between long- and short-run elasticities of demand or supply rests on the tacit assumption that expectations are static, i.e., that people believe that current prices or incomes will persist indefinitely. When expectations are not static it is no longer true that the long-run elasticity of supply or demand *necessarily* exceeds the short-run elasticities.

When we attempt to analyze the effects of non-static expectations, we face two basic problems: (1) Expectations are not generally single-valued; how then can we introduce them into our analysis in a meaningful yet sufficiently simple way? (2) A wide variety of factors which are not quantitative in nature contribute to the formation of expectations, such as, for example, incidents of international importance in the Middle East. Notwithstanding these difficulties, progress may be made in understanding the effects of non-static expectations through the use of explicit dynamic models of expectation formation.

A meaningful concept of expectations (yet one which treats them as single-valued) is that of expected "normal" price or income, i.e., the *level* about which future prices or incomes are expected to fluctuate.[2] If

[1] The argument hinges on the fact that the minimum cost of producing an additional unit of output cannot be less when an entrepreneur's freedom of choice is limited than when he is completely free to choose, because he always has the alternative of choosing exactly that situation to which he was previously limited. See Friedman, Milton, *Lectures in Price Theory*, unpublished mimeographed notes (Chicago, 1951), pp. 119-124.

[2] See Arrow, Kenneth J., and Marc Nerlove, "A Note on Expectations and Stability," *Econometrica*, Vol. 26 (April 1958);

Friedman, Milton, *A Theory of the Consumption Function* (Princeton: Princeton University Press, 1957);

changes in expected "normal" price or income are *induced* by changes in current prices or incomes, simple but meaningful models of expectation formation may be constructed.[3] One such model which seems particularly appropriate is that derived from Hicks' definition of the elasticity of expectations[4] [11, p. 205] by setting the elasticity equal to a constant.[5] Let z_t^* be the expected "normal" level of a variable at time t, and let z_t be the actual level; then

$$(1) \qquad \overset{*}{z}_t - \overset{*}{z}_{t-1} = \beta[z_t - \overset{*}{z}_{t-1}], \qquad 0 < \beta \leq 1.$$

β is called the elasticity or coefficient of expectations according to whether z^* and z are expressed in logarithms or not. In words, the model states that in each period people revise their notion of what is "normal" in proportion to the difference between what actually happened and what they previously considered as "normal."[6] When the elasticity or coefficient of expectations is one, expectations are static; when it is less than one, the expected "normal" fluctuates less than does the actual.

If supply depends on expected "normal" prices and demand on expected "normal" income and prices as well as on current prices, the introduction of non-static expectations in the manner suggested leads to yet another reason why the long-run elasticity should exceed the short-run

Nerlove, Marc, "Estimates of the Elasticities of Supply of Selected Agricultural Commodities," *Journal of Farm Economics,* Vol. 38, May, 1956, pp. 496-509;

Nerlove, Marc, *Estimates of the Elasticities of Supply of Corn, Cotton, and Wheat,* unpublished Ph.D. thesis, Johns Hopkins University (Baltimore: 1956), pp. 41-59;

Nerlove, Marc, *Using Distributed Lags in the Analysis of Demand for Agricultural and Other Commodities,* forthcoming publication of the U. S. Department of Agriculture (1958).

Friedman deals only with income and calls his concept "permanent" income rather than "expected 'normal' " income.

[3] Changes in expected "normal" prices or income may be thought of as divided into two components: (1) autonomous, and (2) induced. See Enthoven, Alain C., and Kenneth J. Arrow, "A Theorem on Expectations and Stability," *Econometrica,* Vol. 24 (1956) p. 289. Autonomous changes in expectations are the result of particular causal factors such as, for example, changes in the levels at which the prices of certain farm commodities are supported or the incidents of international importance to which I referred above. Part of any change in expectations, however, typically is induced by a change in current conditions. If people knew in every instance exactly what caused a change in the current value of an economic variable, no changes in expectations would be induced: any change in expectations would be directly related to specific causal factors. The typical producer or consumer, however, is not generally aware of the specific reasons for a change in current conditions. He therefore uses the past and present as his guide to the future.

[4] Hicks, J. R., *Value and Capital,* 2nd ed. (Oxford: Clarendon Press, 1946), p. 205.

[5] See Arrow and Nerlove, footnote 2.

[6] The differential equation analogue of equation (1) has been used by Friedman (footnote 2); Cagan, Phillip, "The Monetary Dynamics of Hyper-Inflations," in M. Friedman, ed., *Studies in the Quantity Theory of Money,* Vol. I (Chicago: University of Chicago Press, 1956); and Arrow and Nerlove (footnote 2). I have used it in the difference equation form in my work on supply functions (see second and third Nerlove references in footnote 2). The model is due originally to Cagan.

elasticities. Consider, for example, a consumer who experiences a sudden increase in income. Initially, he may not believe that his income will remain permanently at the new level and therefore does not adjust his consumption of various goods and services to the fullest extent. But, as time passes, if his income does remain at the new level, he will gradually come to believe in its permanence and act accordingly.[7]

The Problem

Why the short-run elasticity cannot be estimated. It should now be clear why we cannot measure *the* short-run elasticity of supply or demand: through each point on a long-run supply or demand curve passes a fan of short-run curves, each one appropriate to a different interval of time. Thus, there is no unique short-run elasticity of supply or demand with respect to price or any other variable; the short-run elasticity differs depending on the position from which we start and the length of time we allow for adjustment. This is an elementary observation, but it has significant implications for the estimation of long-run elasticities.

Why the long-run elasticity cannot be estimtaed directly: an illustration. Consider the problem of estimating the long-run elasticity of demand. Suppose that we abstract from changes in real income and the prices of goods other than the one in question. This is done solely to facilitate a diagrammatic exposition; the abstraction involves no real loss of generality. Further suppose that supply is perfectly elastic, so that we may deal with the problem in the absence of difficulties caused by the existence of simultaneous relations among the variables.[8] I assume that observations on price and quantity are taken at discrete time intervals of a fixed length and that full adjustment to changed conditions does not take place within the time length of the intervals.

Figure 1 illustrates these assumptions for a once-and-for-all change in price. The curve D_LD_L is the long-run demand curve. The point B on D_LD_L represents an equilibrium of demand and supply: At a price OA, the quantity AB is consumed each period. If the supply curve shifts so that the price is now OC, the quantity consumed does not increase immediately to CP, where P is a point on the long-run demand curve, but to CD, where D is a point on one of the short-run demand curves through B. If the price were to remain at OC, we would observe the quantity CE consumed the following period, then CF, then CG, CH, and

[7] Considerations of this type are important in Friedman's work on the consumption function (see footnote 2).

[8] A concrete example of a situation in which supply may be taken as perfectly elastic is the market for certain imported foodstuffs in a country which consumes but a small part of the world supply. This is the principal reason why demand analyses for the U.K. have been used in the statistical analyses based on the methods proposed in this paper.

so on. Each of the points, D, E, F, G, H, etc. lie on different short-run demand curves through the point B. As time passes they gradually approach the point P which lies on the long-run demand curve.

Of course, in any realistic situation price will be changing constantly; hence, the points we observe never lie on the long-run demand curve. Figure 2 illustrates this situation. We start out, as before, from an initial

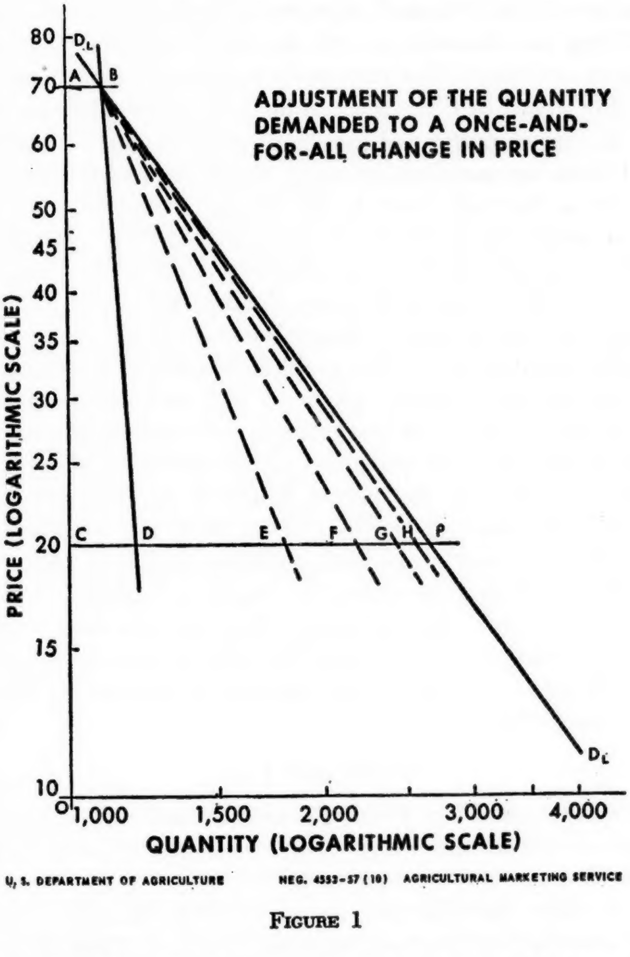

Figure 1

equilibrium point B on the long-run demand curve D_LD_L. Now, however, let supply shift in such a way that the price falls constantly, first to OC, then to OE, OG, OI, and so on. When the price falls from OA to OC, consumers adjust their consumption from AB to CD. If the price remained at OC, they would consume CW the following period; but the price falls again to OE. Consequently they move along a new short-run demand

curve through the point W to F. They consume slightly more than they would have had the price remained at OC. Thus, as price falls, we observe a series of points, D, F, H, J, L, etc., which all lie on different short-run demand curves passing through different points on the long-run demand curve. A curve approximately passing through these points, $D_E D_E$, has neither the average elasticity of the short-run curves nor the elasticity of the long-run curve. The curve $D_E D_E$ is the sort of demand curve that would be estimated were we to neglect the whole problem of short and long run demand; i.e., it is the sort of demand curve which has usually been estimated. You can easily see that the position, elasticity, and even the shape, of the estimated demand curve, $D_E D_E$, depend crucially on the exact pattern of assumed price changes: in particular, if price had been assumed to fall more slowly we would have obtained an elasticity of demand closer to the long-run elasticity. We can even conceive of situations in which the measured elasticity exceeds the long-run elasticity or falls short of the shortest of short-run elasticities. The estimated curve is neither a short-run demand curve nor a long-run demand curve. In fact, it is not a demand curve at all!

Generality of the problem. The problem illustrated in Figure 2 is quite general and applies to supply curves as well as demand curves and to situations in which more than just quantity and own-price are considered. Whenever it takes time for producers or consumers to adjust to changed conditions and wherever the period which is required for full adjustment exceeds the interval of observation, then statistical relationships among observations on the relevant variables, each of which is taken at the same time, tell us little about the long-run elasticity or any of the short-run elasticities. I would argue that the situation envisaged is sufficiently typical that account should be taken of the difficulty in further studies on demand or supply. The method of distributed lags offers a solution to the problems.

Distributed Lags

What is a distributed lag? Irving Fisher was the first to use and discuss the concept of a distributed lag.[9] Distributed lags arise in theory when any economic cause (for example, a price change or an income change) produces its effect (for example, on the quantity of a good demanded) only after some lag in time, so that this effect is not felt all at once, at a single point of time, but is distributed over a period of time. Thus,

[9] Fisher, Irving, "Our Unstable Dollar and the So-called Business Cycle," *Journal of American Statistical Association*, Vol. 20 (1925), pp. 179-202; *The Theory of Interest as Determined by Impatience to Spend Income and Opportunity to Invest It* (New York: Kelley and Millman, Inc., 1954); "Note on a Short-cut Method for Calculating Distributed Lags," *Bulletin of the International Statistical Institute*, Vol. 29 (1937), pp. 323-327.

when we say that the quantity of cigarettes demanded is a function of the price of cigarettes taken with a distributed lag, we mean, essentially, that the *full* effects of a change in the price of cigarettes are not felt immediately, but that the effects are felt gradually so that the full effect is realized only after a period of time has elapsed, perhaps a considerable period. So stated this is the same sort of thing we have in mind when we

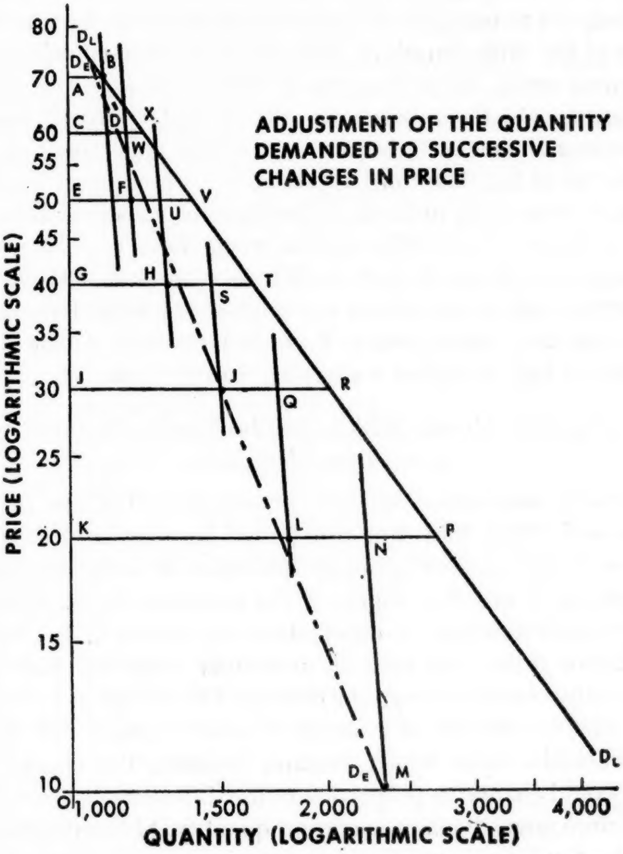

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FIGURE 2

distinguish between short- and long-run elasticities of supply or demand. Thus the formulation of economic relationships containing distributed lags is related to the problem of formulating meaningful relationships among variables we can observe, and the problem of estimating distributions of lag is really the problem of estimating long-run elasticities.

Estimation of distributed lags. The problem of estimating a distribution of lag may be attacked in several ways: (1) We may make no assumption

as to the form of the distribution; this approach has been taken by Alt[10] and Tinbergen.[11] (2) We may assume a general form for the distribution of lag and estimate the parameters which define the exact distribution; this approach has been taken by Fisher,[12,13] Koyck,[14] Cagan,[15] and Friedman[16] and is suggested by Alt.[17] (3) Finally, we may develop an explicit dynamic model of producer or consumer behavior which implies a distributed lag only incidentally. These models may be used directly in an analysis designed to estimate the long-run elasticity of demand or supply.

Because of the finite length of, and degree of auto-correlation in most economic time series, the first approach where nothing is assumed is not always feasible. On the other hand, the second approach must necessarily contain a somewhat arbitrary assumption concerning the form of the distribution of lag. The third approach leads to a direct interpretation of the distribution of lag in terms of producer or consumer behavior and, therefore, in terms of the difference between short- and long-run elasticities of supply or demand. Such models may be used without reference to the distributions of lag which are implied. In what follows, I adopt the third approach; consequently, there is little need to use the phrase "distribution of lag" except as a short-hand expression.

Dynamic Models Which May be Used to Estimate Long-Run Elasticities

Based on the assumption of static expectations. Perhaps the simplest dynamic model which leads to a distributed lag may be derived directly from Figure 1. Let $\bar{q}_t$ be a quantity demanded in long-run equilibrium, i.e., a length, such as CP in Figure 1, the end-point of which lies on the long-run demand schedule. If expectations are static, $\bar{q}_t$ is a function of current relative price, real income, and other variables. Let q_t be the current quantity consumed, e.g., the distance CD in Figure 1. Very simply, I suppose that in absence of changes in relative price, real income, or the other variables upon which demand depends, the current quantity consumed would change in proportion to the difference between the long-run equilibrium quantity and the current quantity. My assumption may be expressed by the following difference equation

$$q_t - q_{t-1} = \gamma[\bar{q}_t - q_{t-1}], \qquad 0 < \gamma \leq 1, \tag{2}$$

[10] Alt, F. F., "Distributed Lags," *Econometrica*, Vol. 10 (1942), pp. 113-128.

[11] Tinbergen, J., "Long-term Foreign Trade Elasticities," *Metroeconomica*, Vol. I (1949), pp. 174-185.

[12] See first Fisher reference, footnote 9.

[13] See third Fisher reference, footnote 9.

[14] Koyck, L. M., *Distributed Lags and Investment Analysis* (Amsterdam: North-Holland Publishing Co., 1954).

[15] See Cagan reference, footnote 6.

[16] See Friedman reference, footnote 2.

[17] See footnote 10.

where γ is a constant of proportionality which I call the elasticity or coefficient of adjustment according to whether quantity is expressed in logarithms or not.[18] Thus, in Figure 1, the ratio of DE to DP represents the elasticity of adjustment, γ.

Let p_t be the logarithm of relative price and y_t the logarithm of real income. If a is the long-run price elasticity, b the long-run income elasticity, and c a constant, the long-run demand function may be written

$$\bar{q}_t = ap_t + by_t + c. \tag{3}$$

Equation (3) corresponds to the curves labeled D_LD_L in Figures 1 and 2.

We cannot observe the long-run equilibirum quantity consumed because price and income are continually changing; therefore, we cannot estimate an equation such as (3). By substitution of (3) into (2), however, we obtain

$$q_t = a\gamma p_t + b\gamma y_t + (1 - \gamma)q_{t-1} + c\gamma, \tag{4}$$

which can be estimated. Equation (4) is not any sort of a demand function but merely a relationship among observable variables. It is useful because it is possible to derive estimates of the long-run elasticities of demand with respect to price and income from estimates of its parameters. The long-run price elasticity of demand may be obtained by dividing the coefficient of current price in (4) by one minus the coefficient of lagged quantity; the long-run income elasticity of demand may be obtained in a similar way. Demand analyses based on equation (4) are currently under way. They involve data for the United Kingdom, 1920-38, developed by Stone[19] and Prest.[20] The results obtained thus far indicate a definite tendency for both the long-run income and price elasticity to differ significantly from the corresponding short-run elasticities. Furthermore, many of the results are appreciably better than those which Stone obtained with substantially the same data.

The simple model under discussion may be easily adapted for the estimation of long-run elasticities of supply of specific agricultural commodities. If farmers have static expectations and base their production plans on prices at the preceding harvest, we may write a simple long-run supply function

$$\bar{x}_t = dp_{t-1} + e, \tag{5}$$

[18] This model is identical with one which Allen gives for generating distributed lags of a particular sort. See Allen, R. G. D., *Mathematical Economics* (New York: St. Martin's Press, 1956), pp. 166-170. It should be noted that Allen's model is expressed in differential rather than difference equation form as above. Allen also gives several other interesting models which lead to closely related types of distributed lags. It is to be hoped that these will be explored in further research.

[19] Stone, Richard, *The Measurement of Consumers' Expenditure and Behavior in the United Kingdom, 1920-38,* Vol. I (Cambridge: Cambridge University Press, 1954).

[20] Prest, A. R., "National Income of the United Kingdom, 1870-1946," *The Economic Journal,* Vol. 58 (1948), pp. 31-62.

where $\bar{x}_t$ is *planned* long-run equilibrium output.[21, 22] Let the dynamic adjustment equation, corresponding to (2), be

$$x_t - x_{t-1} = \gamma[\bar{x}_t - x_{t-1}], \qquad 0 < \gamma \leq 1, \tag{6}$$

where x_t is current planned output. Substitution of (5) in (6) yields a relation which is not a long-run supply function but which can be estimated statistically:

$$x_t = d\gamma p_{t-1} + (1 - \gamma)x_{t-1} + e.^{23} \tag{7}$$

The long-run elasticity of supply may be estimated from estimates of the coefficients in equation (7). The method is similar to that I have previously described in connection with demand. Statistical supply analyses for commercial vegetables produced for fresh market in the United States are currently under way at the United States Department of Agriculture. These analyses form part of a more extensive study on the methodology of supply analysis. For preliminary analyses, the results thus far have been very good: multiple correlation coefficients in excess of 0.95 have typically been obtained. This high degree of "explanation" is not found in analyses conducted along more traditional lines. Furthermore the signs and magnitudes of the coefficients are reasonable, and there is little or no evidence of serial correlation in the unexplained residuals.

Involving the assumption of non-static expectations. The foregoing dynamic models, while based on the assumption of static expectations, really introduce non-static expectations through the back door, so to speak. The models just presented are based on Figure 1 and one of the factors which led me to draw Figure 1 as I did was the existence of non-static expectations of the sort generated by equation (1). Hence, non-static expectations are already implicitly included.

When we attempt to include non-static expectations explicitly, and in particular to introduce equations such as (1), the models we come up with are no longer quite as simple as the ones already discussed. Because of the complexity of models which introduce non-static expectations explicitly and because I have dealt at some length with the problems

[21] In an earlier article (see second Nerlove reference in footnote 2), I took issue with the common assumption that farmers base their production plans on last year's price. The considerations on which my view was based are still important, I believe, but they are not relevant in the present context since static expectations have been explicitly assumed.

[22] For various reasons it is useful to represent planned output by planted or harvested acreage. This is done in the supply analyses for commercial vegetables for fresh market currently under way at the U. S. Department of Agriculture.

[23] Equation (7) is identical to equation (4) of second Nerlove reference in footnote 2. The former is based on the assumption of static expectations, while the latter is based on non-static expectations of the sort generated by equation (1) above. All traces of this similarity disappear, however, when more than one price is included in the long-run supply function.

involved elsewhere,[24] I shall not discuss them here.[25] Methods for dealing with these problems have been developed; such results as are now available suggest, however, that little improvement can be obtained by introducing non-static expectations explicitly.

Recapitulation

Whenever it takes time for producers or consumers to adjust to changed conditions and whenever the period which is required for full adjustment exceeds the interval of observation, then statistical relationships among observations on the relevant variables, each of which is taken for the same period, tell us little about the long-run elasticity or any of the short-run elasticities. The problem involved is closely related to the problem of estimating distributed lags. Simple dynamic models of producer or consumer behavior may be formulated; these may be used in statistical analyses designed to estimate long-run elasticities. Statistical results based on these models are nearing completion and are promising. Those obtained thus far indicate that the problem discussed here is an important one and that an almost total neglect of it by previous workers leaves their results open to serious question.

[24] See final Nerlove reference, footnote 2.

[25] One reason for the increased complexity is as follows: Equation (3) involves two variables, price and income. One parameter, γ, is needed to estimate *both* long-run elasticities from the coefficients of price and income in equation (4). Another way of saying the same thing is to say that the distributions of lag for both price and income are the same. When non-static expectations are introduced explicitly by means of equations such as (1), it is no longer true that the distributions of lag for different variables in the same equation are the same. Herein lies the chief difficulty.

DISCUSSION: DISTRIBUTED LAGS AND THE MEASUREMENT OF SUPPLY AND DEMAND ELASTICITIES

K. W. MEINKEN
Rutgers University

First, I would like to congratulate Bob Gustafson and Marc Nerlove on two very fine papers. It is not very often that I have the opportunity to discuss papers of such high caliber. I would like, however, to confine my remarks solely to Nerlove's paper. In reading it, it seemed to me that it could be reviewed or discussed from two viewpoints: (1) as a mathematical economist or (2) as an applied agricultural economist. If for no other reason than to provide balance to the discussion, I prefer to discuss it from the latter viewpoint.

I believe the very least I can say about Nerlove's paper is that it is challenging. His thesis "it is impossible to measure the short-run elasticity

of supply or demand, and that only under special conditions is it possible to measure the long-run elasticities directly" should cause applied workers to pause and give some thought to differentiating between the short- and long-term.

On first reading of this paper, Elmer Working's classic article, "What Do Statistical Demand Curves Show?" came at once to my mind. For this is exactly the question that Nerlove raises but for an entirely different reason. While it took about 15 years to finally answer Working's question, Nerlove answers his question in the same breath that he raises it. This is always a neat trick. Breimyer, in a recent article in the *Journal of Farm Economics*, observed that "demand has been analyzed, cross-analyzed, re-analyzed without respite." It appears that we are not yet done with the subject.

The second reading, and particularly the sentence "—and that an almost total neglect of it by previous workers leaves their results open to serious question," brought to mind another article of Working's, "Indications of Changes in the Demand for Agricultural Products." In this article he pondered the distinction between "market demand curves, short-time normal demand curves, and long-time normal demand curves." This was in 1932. More recently, Working in his report, "The Demand for Meat," very carefully considered the "dynamics of demand" in the exact sense that Nerlove uses it. For example, he states: "situations where a change in a causally important variable has a different effect depending upon its rate of change or upon the length of time which has elapsed since the change occurred." In addition, he pointedly notes that "there is a difference between the short-run and long-run elasticity of demand for meat." I would have liked to have seen one small footnote acknowledging that at least one applied agricultural economist, Elmer Working, had given careful consideration to the problem. While I am at it I note that Mighell and Allen in their article "Demand Schedules—'Normal' and 'Instantaneous'" also carefully considered the problem.

In the two statistical models (equations 4 and 7) that Nerlove presents as a solution to the problem of obtaining long-run elasticities of demand and supply, I have some small reservations. If the research worker is in mad pursuit of high values of R he will wish to use these models. For if, in a correlation study, the data we are working with are time series data and if the dependent variable is correlated with time, then including as an independent variable the dependent variable with a lag, high values of R will automatically be obtained. The value of R will, of course, be determined by the extent that the dependent variable is correlated with time. In analyses now under way at the USDA using these models, Nerlove indicated that the results (R's) are "nothing short of extraordinary."

This doesn't surprise me as almost all our acreage and consumption series show a high degree of trend.

Whenever a new model appears there is always a strong temptation by applied workers to try and force every commodity to conform to it. If the supply model is used to obtain long-run elasticities with respect to crop acreage, I can state flatly that for crops which agricultural economists classify as "catch crops" results will be negative. For example, acreage planted to grain sorghum can be expressed as a function of acreage planted to wheat in the preceding fall and cotton acreage in cultivation July 1. Prices and costs are not "explanatory" variables for these crops.

Despite the slight reservations that I have, I anticipate some very significant analyses to result from the use of these models. I suspect that they will prove more applicable on the supply side than on the demand side.

DISCUSSION: ECONOMETRIC RESEARCH IN AGRICULTURE

HAROLD W. WATTS
Yale University

I also would like to congratulate the authors for presenting interesting and challenging papers. Their efforts have made the task of this discussant a very pleasant one.

Gustafson has, in my view, taken a very broad step toward rational and explicit analysis of an important practical problem. I can neither quarrel with his methods nor detect errors in his mathmatics. I would, however, ask if the analysis is sufficiently complete to be used for policy recommendations. The main deficiency I see is the neglect of supply considerations.

The model assumes that the crop in each year is independent of the price and quantity sold in the preceding year. On the other hand, it seems to me that the crucial problem for an intelligent, if not optimal, agricultural policy hangs precisely on the supply side of the market. Specifically, if the acreage planted in year $t + 1$ depends on the price of year t, then the choice of a storage rule for year t should not be made without considering the consequences for the supply in the following year. The effect of taking these consequences into account would probably be an increase in the average level of carry-over. If the year following a bumper year is likely to be a short year because of the low price in the bumper year, then the carry-over stock will have a higher marginal social value than Gustafson gives it in his model.

There may be good and sufficient reasons for rejecting the notion that

production depends on price. But, since the usual presumption of economists is quite the opposite, those reasons should be made clear before the policies are recommended for use.

With regard to Nerlove's paper, I have two comments—both relatively minor. First, I would prefer seeing the stochastic assumptions of the model spelled out explicitly. Nothing is said about the source of deviations from the hypothesized functions up to the point where we are asked to consider the statistical estimation of their parameters.

Second, I would like to pick on a statement in the paper which alleges that the supply equation (equation 7), built on the assumption of static expectations, really introduces non-static expectations through the back door. I don't know exactly what this means.

A supply model with non-static expectations of the Hicksian type but without lagged quantity adjustment can be constructed which will provide the same kind of estimation equation as does Nerlove's model. The only difference is that the coefficient of expectations replaces the coefficient of adjustment.

If, however, both lagged adjustment and non-static expectations are explicitly included in a comparable model, then the relation between actual prices and quantities involves a two period lag on quantity. Following Nerlove's general approach let x_t^* be planned long-run equilibrium output and p_t^* be price expectations. The supply equation is assumed to be:

$$\overset{*}{x}_t = d\overset{*}{p}_t + e.$$

The quantity adjustment equation is:

$$x_t - x_{t-1} = \gamma(\overset{*}{x}_t - x_{t-1}).$$

Price expectations are generated according to the equation:

$$\overset{*}{p}_t - \overset{*}{p}_{t-1} = \beta(p_{t-1} - \overset{*}{p}_{t-1}).$$

The relation among observable variables x_t and p_t is now:

$$x_t = \gamma\beta dp_t + [(1-\gamma) + (1-\beta)]x_{t-1} - (1-\gamma)(1-\beta)x_{t-2} - \gamma\beta e.$$

It is still possible to estimate the coefficients of the long-run supply equation (d and e) provided the regression includes two periods of lag on quantity. There is some question about the original statement however. It seems to me that if non-static expectations enter through the back door, then the coefficients of equation 7 that come out the front door will not be so easy to interpret as they would otherwise be.

STRUCTURAL CHANGES IN THE MEAT WHOLESALING INDUSTRY*

WILLARD F. WILLIAMS
Marketing Research Division, USDA

FUNDAMENTAL and deep-rooted structural and organizational changes are in evidence in the processing and marketing sectors of the nation's agricultural economy as well as at the producer level. Judging, however, from the nature and results of agricultural economic studies made in recent years, the structural changes in the processing and distributive industries appear to have been largely ignored by research technicians. There are several possible reasons for this apparent indifference. Some researchers, the institutionalists particularly, seem to have been content after calculation of a few concentration ratios to toss all questions arising from structural changes into the political arena. Others have sagely dismissed them with the observation that the structural changes which have come about appear to have been accompanied by improvements in operational efficiency and little, if any, degeneration in pricing efficiency.[1] Still another group, it appears, avoids studies of industry structure for the reason that the reseach techniques and tools available are inadequate.

It is difficult to believe that the obstacles to study of market structure, although formidable, are insurmountable. In addition, the economic effects of changes in the structure of processing and distributing industries are of primary concern, today, to producers, business concerns, trade associations, other industry leaders, and legislators. Accordingly, an expanded program of research on market structure appears defensible. First, however, we need to know the nature and extent of structural changes under way and this, as related to a particular industry, is the principal task undertaken in this paper. Second, and involved here is a challenge to theoreticians and econometricians, principles are needed which explain (1) expected effects of various factors or conditions on market structure, and (2) the effects of market structure on such factors as prices, costs and output. The principles, when provided, can be used to adjust for inapplicabilities of presently available models to study of structural change.[2] They can be used either to develop new models or to modify

* A paper prepared for the Philadelphia meeting, Winter 1957, of the Econometric Society, December 30, 1957.

[1] "Pricing efficiency," as used here, is concerned with the price-making role of the marketing system. It concerns how accurately, how effectively, and how freely the marketing system makes prices which measure the final product values to the ultimate consumer and reflects these values through the various stages of the marketing system to the producer.

[2] Even the more elegant systematized models currently in use provide for essentially unchanged conditions with respect to structure.

the models now available for use by partialing out some of the effects of structural change. Until this is accomplished it is difficult to see how researchers could know whether structural changes have or have not had a large impact on either operational efficiency or pricing efficiency.

Structural Changes in the Meat Wholesaling Industry

The meat wholesaling industry is defined in this paper to include all packing (slaughtering) plants, packer branch houses, independent wholesale distributors and procurement operations of retailers. "Changes in industry structure" are defined as significant or important changes in interfirm economic relationships.[3]

This industry, with the exception of the retailing sector, is one wherein the widely recognized dominance of a few firms and evidence of little technological progress have led to a general assumption of relative stability in structural and competitive relationships among firms. Initial descriptive studies, however, are leading to the realization that meat wholesaling should be of particular interest to the economic researcher for several reasons.[4] First, striking changes in structure and the nature of competition in the industry are in evidence. Second, these changes are resulting in economic effects of considerable importance to producers and consumers as well as the industry itself. Third, the changes and their impacts appear quite different from those characteristic of many other agricultural industries.

Structural changes at the packer level

It has been stated that in the processing and distribution of farm products, the typical organizational pattern is that of a few large firms handling a major share of the total business, with a relatively large number of

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[3] With these definitions I unceremoniously cut my way through the maze of concepts and arguments which have long clouded discussions of market structure. For the moment, I ignore or reject as operationally unworkable definitions of "markets," "firms," and "industries" as formulated by Triffin. I refer to meat packing as an "industry," admittedly a part of the meat wholesaling industry as defined above, largely for want of a better word. The definition of structural changes provides a reasonable degree of distinction between industry structure and structure of the firm despite the fact that intrafirm adjustments could conceivably have some interfirm repercussions.

[4] Among these are (1) a study of wholesale meat distribution in the San Francisco Bay Area, (2) a similar, although more intensive, study of meat wholesaling in the Los Angeles area, (3) a more general study of industry structure and of the economic effects of the use of federal grades for beef, and (4) analyses of published data such as that in Bureau of Census reports. Results only of the first of these have been published. See Willard F. Williams, *Wholesale Meat Distribution in the San Francisco Bay Area*, Marketing Research Report No. 165, United States Department of Agriculture, April 1957.

firms handling the remainder.[5] In this sense the meat-packing industry has been and remains typical. Conditions in this industry, however, have changed greatly since about 1940, when Nicholls, Hoffman, and others were so vitally concerned with large scale organization in the meat-packing industry. Writing in 1940, Hoffman stated:

"The introduction of artificial refrigeration about 1875 literally revolutionized the packing industry. It now became possible to centralize livestock slaughter in midwestern cities like Chicago where economies of transportation dictated that it should be located. With geographical centralization came the opportunity to establish large plants and to apply methods of mass production to the slaughtering process itself . . . Suffice it to say that the process is such that it never can be decentralized and carried on by small enterprises . . ."[6]

"Never" is a strong word indicating that Hoffman underestimated the influence of additional technological and organizational developments because this is precisely what has been happening. Decentralization *is* taking place in the industry, and relatively small volume, independently owned, commercial packers *are* growing rapidly in size and number.

Changes in number and size of packing firms

Number and volumes of independent wholesale packers increased rapidly during World War II. In the period 1950-55, as shown in Table 1, the total number of packing plants dropped slightly, but the entire decline was accounted for by reductions in the number of small butchering establishments. Numbers of federally inspected packing plants increased slightly but numbers of "other wholesale" packing plants, those slaughtering two million or more pounds (liveweight) of livestock per year, increased by nearly a third. Among independents, many of the small local establishments apparently have grown greatly in volume to become wholesale packing plants.[7] At the same time, it is known that in the period since 1950, numbers of packing plants operated by the dominant firms, the so-called national packers have remained substantially unchanged or have declined in most parts of the nation. Two of the four largest firms have gone through retrenchment programs in which numbers

[5] Editor's note by Frederick V. Waugh, *Readings on Agricultural Marketing*, The Iowa State College Press, 1954, p. 246.

[6] Hoffman, A. C., *Large-scale Organization in the Food Industries*, Temporary National Economic Committee, Mono. No. 35, Washington, D.C., 1940, p. 15.

[7] The "local" and "other wholesale" plants are owned almost exclusively by independent operators. Most of the federally inspected plants are also owned independently, but this classification includes nearly all of the packing plants of national packers. A "national packer" is characterized by ownership or control of a national system of distribution.

TABLE 1. NUMBER OF MEAT-PACKING PLANTS BY TYPE AND PERCENTAGE CHANGES, 1950–55, UNITED STATES

Type of plant	Meatpacking plants		Percentage change 1950–55
	1950	1955	
	Number	*Number*	*Per cent*
Wholesale:			
Federally inspected	441	455	+ 3.2
Other[1]	725	952	+31.3
Local[2]	2,072	1,810	−12.6
Total	3,238	3,217	− .6

[1] Includes nonfederally inspected plants slaughtering over two million pounds liveweight annually.
[2] Includes nonfederally inspected plants slaughtering less than two million pounds liveweight but more than 300,000 pounds annually.
Source: Number of Livestock Slaughter Establishments, March 1, 1950, and *Number of Livestock Slaughter Establishments*, March 1, 1955, both by Agricultural Marketing Service, United States Department of Agriculture, Washington, D.C.

of plants were closed and others of these firms appear headed in that direction.

A marked trend toward geographic decentralization in the meat-packing industry has been in process for many years.[8] Slaughter volumes in Chicago, eastern slaughtering centers, San Francisco, and certain other large metropolitan centers have dropped sharply. Livestock slaughter in outlying areas, meanwhile, has increased even more sharply.

Concentration in meatpacking

Concentration is less of a factor in the meat-packing industry today than at any time in the last half century. For cattle, the percentage of commercial slaughter accounted for by the four leading firms has dropped steadily from about 54 per cent in 1916 to about 31 per cent in 1954, a decline of 43 per cent in relative position (Table 2). A downtrend in concentration with respect to hogs and sheep and lambs also began with the growth of small interior packers during and immediately following World War I. However, the percentages of hogs and sheep representing slaughter of the four leading firms leveled off or increased again after 1924 until along in the late 1930's.[9] Concentration in calves increased steadily until about 1930.

The downtrend in concentration reappeared during World War II and has accelerated. Since about 1940, the four leading firms have accounted for a rather steadily decreasing percentage of industry slaugh-

[8] As early as 1940 Hoffman noted, despite his general conclusion presented above, "some tendency toward decentralization," *op. cit.*, p. 17.
[9] Hoffman attributed reductions in concentration levels following World War I to introduction and increased use of the Motortruck, *op. cit.*, p. 17.

TABLE 2. PERCENTAGES OF TOTAL COMMERCIAL SLAUGHTER ACCOUNTED FOR BY THE FOUR LEADING MEAT PACKERS BY SPECIES FOR SPECIFIED YEARS, UNITED STATES[1]

Year	Percentages of total commercial slaughter accounted for by four leading firms			
	Cattle	Calves	Sheep and lambs	Hogs
	Per cent	*Per cent*	*Per cent*	*Per cent*
1916[2]	53.9	32.1	70.2	51.2
1924	50.5	40.1	66.4	44.7
1929	49.9	46.9	70.7	40.2
1935	46.6	46.3	70.5	41.4
1947	38.3	39.6	67.8	40.4
1955	30.8	34.7	58.5	36.4
Percentage change 1916–55	−42.9	+8.1	−16.7	−28.9
Percentage change 1935–55	−33.9	−25.1	−17.0	−12.1

[1] Includes the following four companies for each of the years shown: Swift, Armour, Wilson, and Cudahy.
[2] Includes Morris and Co. acquired by Armour and Co. in 1923.
Sources: Federal Trade Commission, *Agricultural Income Inquiry, Pt. 1: Principal Farm Products*, 1937, p. 198 and *Unfair Trade Practices in the Meat Industry*, Hearings before the Subcommittee on Antitrust and Monopoly of the Committee on the Judiciary, United States Senate, First Session, May 10, 1957, pp. 261–65.

ter of each of the several species (Table 2).[10] In the period 1935-55 reductions in levels of concentration among the four leading firms were: Cattle, 38 per cent; calves, 25 per cent; sheep and lambs, 17 per cent; and hogs, 12 per cent.[11]

From 1947 to 1955 when the four leading firms were losing ground rather steadily in each of the four species of livestock, their relative loss was greater for cattle and sheep than for calves and hogs (Table 3). One possible reason for this, as will be noted again below, is that during 1947-55 beef and lamb carcasses were sold largely on a federal grade basis, whereas pork and calf or veal were not.[12] On the other hand, concentration among firms ranking 5th to 10th largest tended to increase, to some extent, during the period 1947-55, but most of this reflected increasing emphasis of these firms on hogs and processed meat products (Table 3).

[10] In absolute terms slaughter of cattle and calves by the four leading firms has remained relatively constant; slaughter of sheep and lambs by these firms has dropped sharply, and the slaughter of hogs has increased.

[11] Throughout, "four leading firms" refers to the four largest slaughterers of cattle in 1955, i.e., Swift, Armour, Wilson, and Cudahy. In the period 1947-55, the "three leading firms," Swift, Armour, and Wilson, lost ground in terms of percentage of total commercial slaughter in each of the four species. The percentage of commercial slaughter accounted for by each of these firms either dropped during the period or remained relatively constant. Since 1955 at least one of the "three leading firms" has closed slaughtering plants at a number of locations.

[12] See page 27.

TABLE 3. COMMERCIAL SLAUGHTER BY SPECIES AND PERCENTAGE OF TOTAL COMMERCIAL SLAUGHTER OF CATTLE, CALVES, SHEEP AND LAMBS, AND HOGS ACCOUNTED FOR BY SELECTED GROUPS OF LARGEST MEAT PACKING FIRMS, 1947–55[1,2]

Year	Total commercial slaughter	Four largest	5th–10th largest	10 largest	Total commercial slaughter	Four largest	5th–10th largest	10 largest
	1,000 head	*Per cent*	*Per cent*	*Per cent*	*1,000 head*	*Per cent*	*Per cent*	*Per cent*
			Cattle				*Calves*	
1947	21,533	38.3	5.3	43.6	13,013	39.6	5.5	45.1
1948	18,386	35.0	5.5	40.5	11,767	36.0	6.2	42.2
1949	18,013	37.5	5.8	43.3	10,828	36.8	5.6	42.4
1950	17,901	35.9	6.6	42.5	9,973	35.9	5.6	41.5
1951	16,376	32.8	4.9	37.7	8,418	34.9	5.6	40.5
1952	17,856	33.4	5.7	39.1	8,894	33.3	5.2	38.5
1953	23,606	32.9	6.4	39.3	11,668	36.1	5.1	41.2
1954	25,017	32.9	6.7	39.6	12,746	36.1	5.2	41.3
1955	25,758	30.8	7.1	37.9	12,384	34.7	5.7	40.4
Absolute change 1947–55	+4,225	−7.5	+1.8	−5.7	−629	−4.9	+ .2	−4.7
Percentage change in:								
Concentration, 1947–55		−19.6	+34.0	−13.1		−12.4	+3.6	−10.4
Slaughter, 1947–55	+19.6	− 3.8	56.8	+ 3.6	−4.8	−16.8	−1.9	−14.9
			Hogs				*Sheep and lambs*	
1947	61,929	40.4	14.6	55.0	18,207	67.8	9.4	77.2
1948	59,669	39.0	15.5	54.5	16,897	64.5	8.0	72.5
1949	64,761	39.5	16.2	55.7	13,376	66.7	9.9	76.6
1950	69,543	40.2	14.7	54.9	12,852	65.4	10.1	75.5
1951	76,061	39.4	14.3	53.7	11,075	63.8	8.6	72.4
1952	77,690	40.5	15.0	55.5	13,962	62.3	9.4	71.7
1953	66,913	40.4	21.8	62.2	15,967	61.4	10.8	72.2
1954	64,827	37.8	20.4	58.2	15,920	60.3	10.1	70.4
1955	74,442	36.4	21.2	57.6	16,292	58.5	10.0	68.5
Absolute change 1947–55	+12,513	−4.0	+ 6.6	+ 2.6	1,915	− 9.3	+ .6	− 8.7
Percentage change in:								
Concentration, 1947–55		−9.9	+45.2	+ 4.7		−13.7	+6.4	−11.3
Slaughter, 1947–55	+20.2	+8.3	+74.2	+25.8	−10.5	−22.8	−8.0	−21.5

[1] *Unfair Trade Practices in the Meat Industry,* Hearings before the Subcommittee on Antitrust and Monopoly of the Committee on the Judiciary, United States Senate, Eight-fifth Congress for May 29, 1957.
[2] Firms classified by size groups according to relative volume of cattle slaughtered in 1955.

Specialization in the meatpacking industry

Prior to about 1940 few meat packers of any type concentrated on the slaughter of a particular species to the exclusion of all others. In the 1930's and earlier, the smaller meat packer, slaughtering usually for local consumption, found it necessary to handle a full line of fresh red meats. Even at that time, however, the independent packer tended to leave the production of sausage and variety meats to the national packer or to the local processing specialist.

Independent packers at present are tending to specialize in slaughtering and to limit their slaughter to one or two species.[13] Less than one-third of the nation's slaughtering plants handled all three principal species in 1954 (Table 4). More than 20 per cent slaughtered only one species,

TABLE 4. PERCENTAGE OF PACKING ESTABLISHMENTS SLAUGHTERING ONE, TWO, OR ALL THREE SPECIES BY TYPE OF PACKER AND REGION, MARCH 1, 1955[1]

Type of packing plant and region	One species	Two species	All three species	Total
	Per cent	*Per cent*	*Per cent*	*Per cent*
Type of packer:				
Federally inspected	33.7	34.0	32.2	100.0
Nonfederally inspected	18.3	52.5	29.2	100.0
Region:				
Northeast	28.3	43.3	28.4	100.0
North Central	28.2	49.7	22.1	100.0
South	12.2	65.6	22.2	100.0
West	9.6	25.7	64.7	100.0
United States	20.6	49.8	29.6	100.0

[1] Includes all plants with an output of 300,000 pounds or more, liveweight, annually.
Source: Number of Livestock Slaughter Establishments, March 1, 1955, Agricultural Marketing Service, United States Department of Agriculture, Washington, D. C., June 15, 1955, p. 7.

and an additional 50 per cent slaughtered two species. Some are specializing even within species, and this is of particular importance in the slaughter of cattle. Today, many independent packers slaughter steers or heifers only while others specialize in cows. Still others have scaled their operations to handle only the particular within grade qualities which meet the detailed specifications of retail food chains. To an increasing extent, these packers sell in volume by description either directly to chains or to large volume wholesale distributors.

The national packers, on the other hand, usually do not specialize in slaughter of particular species or in the slaughtering operation alone. In

[13] In the western region where data indicate a high percentage of plants slaughtering all species the figures are deceptive. Many of the establishments in this region slaughter so few hogs and sheep or lambs that, essentially, they are one species plants. This has been shown to be true in the study of wholesale meat distribution in the San Francisco Bay Area and is evident in the data of the Los Angeles study. (See footnote 4.)

of eight leading packers, but fresh meats represented only about one-half. 1950, meat products accounted for 82 per cent of the product shipments prepared meats, principally sausage, comprised nearly 30 per cent of all product shipments.[14]

It would appear from Table 3 and related information that the 10 largest firms in the industry are shifting gradually to hogs and to production of smoked, cured and prepared meat products.[15] In addition, it appears reasonable to assume that a markedly larger percentage of the cattle slaughtered by the 10 leading firms in 1954 as compared with 1947 and earlier, consisted of cows and grades or qualities of meat which ordinarily do not enter into fresh meat channels. In short, the current tendency among leading firms in the industry is toward an increased degree of specialization or emphasis upon meat products which usually are processed and prepackaged. These commodities lend themselves well to effective use of private brands.

Nicholls demonstrated a marked tendency for the period 1920-33 toward expansion of slaughter by the four leading firms relative to the rest of the industry with large supplies and toward contraction with small supplies.[16] This appeared to substantiate his hypothesis that the dominant firms provide most of the flexible plant required by the industry to handle the wide year-to-year changes in marketings of slaughter livestock. Correlations for the period 1946-55 between percentage of commercial slaughter of cattle and hogs by the four leading firms and total commercial slaughter of these species yield decidedly nonsignificant results. Data for the later period were affected by the secular downtrend in the percentage of commercial slaughter accounted for by the dominant firms. Nevertheless, the results indicate that during recent years the smaller firms, despite a higher degree of specialization, have been equally capable, in the aggregate, in expanding and contracting slaughter and in taking advantage of lower prices and wider margins produced by large supplies of slaughter livestock.

Structural changes among nonslaughtering wholesale distributors

Prior to World War I, virtually all red meat produced in the nation moved to retailers and dining establishments either directly or through (nonslaughtering) packer branch houses. As late as 1929, packer branches

[14] *Report of the Federal Trade Commission on Industrial Concentration and Product Diversification in the 1000 Largest Manufacturing Companies,* 1950, Federal Trade Commission, January 1947, p. 64.

[15] Little pork in comparison with beef, veal or lamb enters distribution channels in carcass form and a high percentage of it is smoked, cured or otherwise processed by the packer.

[16] William H. Nicholls, *Imperfect Competition Within Agricultural Industries,* Iowa State College Press, 1941, pp. 333-34.

handled almost half of total sales by all packers.[17] However, sharply curtailed branch house operations together with marked growth in the number and business volumes of independent (nonslaughtering) meat wholesalers represent two of the most striking of the structural changes in the wholesale meat industry. Numbers of independent wholesalers about doubled between 1929 and 1954. Business volumes of these firms, as measured by sales adjusted for changes in average wholesale prices of meat, rose 114 per cent in the period 1929-54 and more than doubled during 1939-54 (Table 5). After 1948, price-adjusted sales of independent wholesalers rose several times faster than meat production in the United States, which means that wholesalers have been handling a sharply increasing percentage of the meat produced from slaughter in the nation.

TABLE 5. NUMBERS OF ESTABLISHMENTS AND SALES, ADJUSTED FOR CHANGES IN MEAT PRICES, OF PACKING HOUSE BRANCHES AND INDEPENDENT WHOLESALE DISTRIBUTORS, MEAT PRODUCTION AND PERCENTAGE CHANGES, SPECIFIED YEARS AND PERIODS OF YEARS, UNITED STATES

Year or period of years	Packing house branches		Wholesalers		Packing house branches and wholesalers		Meat production
	Establishments	Sales[1]	Establishments	Sales[1]	Establishments	Sales[1]	
	Number	*$1,000*	*Number*	*$1,000*	*Number*	*$1,000*	*Million pounds*
Year							
1929	1,157	3,727,156	2,225	1,337,164	3,382	5,064,320	16,147
1939	940	2,855,384	2,552	1,378,229	3,492	4,233,613	17,534
1948	756	2,298,085	3,200	1,658,629	3,956	3,956,714	21,300
1954	664	2,697,483	4,357	2,866,193	5,021	5,563,676	25,333
Percentage changes							
1929-39	−18.8	−23.4	+14.7	+3.1	+3.3	−16.4	+8.6
1939-48	−19.6	−19.4	+25.4	+20.4	+13.3	−6.5	+21.5
1948-54	−12.2	+17.5	+36.2	+72.8	+26.9	+40.6	+18.9
1939-54	−29.4	−5.5	+70.7	+108.0	+43.8	+31.4	+44.5
1929-54	−42.6	−27.6	+95.8	+114.3	+48.5	+9.9	+56.9

[1] All sales reflect 1954 price levels since they were adjusted by the index of wholesale prices of meat and meat products, 1947–49=100, adjusted such that 1954=100.
Source: Preliminary Trade Report, 1954 Census of Business, Wholesale Trade, Series P.W. 3-36, October 1956, Bureau of the Census, U.S. Department of Commerce.

Numbers of packing house branches, in contrast with independent wholesalers, fell 43 per cent in the period 1929-54 and their sales dropped 28 per cent in the same period (Table 5). However, in the last six years of this period, 1948-54, aggregate business volumes of packing house

[17] Most packer branch houses are owned and operated by national packers. They are nonslaughtering handling, processing, and sales organizations of packers. Sales of these firms do not include sales made at slaughtering or combination slaughtering and processing plants of the parent companies.

branches increased about in proportion with the growth in volume of total meat production.

The combined price-adjusted sales of packing house branches and wholesalers dropped after 1929 until after World War II, when increases in sales by wholesalers were being more than offset by branch house sales reductions. Meanwhile, meat production in the period 1929-48 increased greatly and this, in combination with evidence of reductions in combined sales by branch houses and wholesalers, indicated that direct sales by packers to retailing outlets were increasing relatively (Table 5). The growth of retail food chains undoubtedly contributed to this relative increase in the direct flow of meat.

In view of the continued growth of retail food chains since 1948, a continued relative increase in the direct flow of meat might have been expected. During 1948-54, however, a 19 per cent increase in total meat production compares with a 41 per cent increase in combined sales of branch houses and wholesalers (Table 5). This is evidence that indirect sales has increased relatively and that there is at least a temporary reversal in the trend toward direct selling by packers despite the dramatic growth of large volume retailing organizations. Direct sales, nevertheless, have retained a dominent position among wholesale channels of meat distribution. Compared with pre-World War II years, direct sales have increased relatively in importance (Table 5).

Regional changes in structure

The national pattern of change among independent wholesalers and branch houses extends, with modifications, throughout the four principal regions of the United States (Table 6). Numbers of packing house branches dropped in all regions. Business volumes of these firms dropped in the North Central and Northeastern regions between 1939 and 1954, but they increased rather markedly in the South and West. The increase in sales by branch houses in the West, however, is accounted for largely by increased shipments of pork to a fast growing area.[18]

The South and West also accounted for the greater percentage increases in sales volumes of independent wholesalers, but even in these regions sales increases were much greater for independent wholesalers than for packer branches (Table 6). The combined sales of packer branch houses and independent wholesalers increased in all regions, more relatively in the South and West, of course, than in other regions.

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[18] Fresh and smoked or cured pork in addition to other processed or prepared meats accounted for 80 per cent of the sales volume of packer branch houses in the San Francisco Bay Area in 1955. Data for the Los Angeles area reveal a similar pattern. See Willard F. Williams, *op. cit.*, p. 12.

TABLE 6. SALES, ADJUSTED FOR PRICE CHANGES, AND PERCENTAGE CHANGES IN SALES, SPECIFIED PERIODS, PACKING HOUSE BRANCHES, INDEPENDENT WHOLESALERS, AND COMBINED TOTALS BY REGION AND UNITED STATES

Type of distributor and region	Sales adjusted for price changes[1]			
	1954	Percentage changes for		
		1939–48	1948–54	1939–54
	$1,000	*Per cent*	*Per cent*	*Per cent*
Packing house branches:				
Northeast	1,098,209	−29.9	+14.8	−19.6
North Central	500,989	−23.0	+9.2	−15.9
South	874,527	−4.4	+25.1	+19.6
West	223,758	+12.2	+22.1	+37.0
United States	2,697,483	−19.5	+17.4	−5.5
Independent wholesalers:				
Northeast	1,359,289	+23.9	+54.0	+90.8
North Central	690,356	+6.3	+82.4	+93.9
South	425,127	+33.0	+119.1	+191.3
West	391,421	+24.2	+92.5	+139.1
United States	2,866,193	+20.3	+72.8	+108.0
Total branch houses and independent wholesalers:				
Northeast	2,457,498	−11.5	+33.6	+18.3
North Central	1,191,345	−12.0	+42.3	+25.2
South	1,299,654	+1.8	+45.4	+48.1
West	615,179	+18.2	+59.1	+88.1
United States	5,563,676	−6.6	+40.6	+31.4

[1] All sales adjusted prior to calculation of percentages by the Index of Wholesale Meat Prices to reflect 1954 levels of price.

Source: Preliminary Trade Report, 1954 *Census of Business, Wholesale Trade,* Series P.W. 3-36, October 1956. Bureau of the Census, U. S. Department of Commerce.

Specialization among nonslaughtering wholesale distributors

Branch houses sell mainly, and in some cases almost exclusively, to independent retailers. As indicated earlier, branch houses in some areas, the West particularly, tend to specialize heavily in the processing and sale of pork and of prepackaged branded items.

Independent wholesalers, on the other hand, differ greatly in terms of functions performed, services rendered, species handled, size and other characteristics. The following are among types which have developed. (1) "Jobbers," "hotel and restaurant supply houses," or "purveyors," specialize in the distribution of meat to eating or dining establishments. (2) "Wholesalers" and "breakers" have increased rapidly in number and volume since 1940. These are relatively large volume firms conforming more closely than the jobber to the definition of wholesaler as used in other food product industries. A few wholesalers concentrate on the distribution of dressed calves or pork but most of them specialize in the purchase of beef carcasses from packers and the sale of wholesale beef cuts. Con-

sequently, they are often referred to as "'beef breakers" or "breakers." (3) "Boners" are principally engaged in removing bones and sinew from lower grade beef carcasses and in selling the meat to processing plants and retailers. (4) "Frozen meat handlers" specialize in chip steaks, veal patties, quick frozen cuts or other frozen meat products. In addition, there are local nonslaughtering meat processors (typified by the sausage factory) not classified by the Census Bureau as a wholesaler but constituting an important part of the meat industry and highly specialized.

Most independent breakers and boners came into existence during World War II, but jobbers also grew in number and volume during this period. Data collected in a recent (unpublished) study show that in 1955 breakers were to be found in principal cities throughout the United States and that independent retailers, jobbers, and retail chains were about equally important to them as customers. The extent of purchases by retail chains from independent wholesalers explains, in part, their coincident growth.[19]

Some Reasons for Structural Changes in Meat Wholesaling and Implications re *Competition*

Clearly, and despite the conviction of Hoffman and others during the late 1930's concerning the irreversibility of the centralizing process, broad structural changes are rapidly altering the characteristics of the meat wholesaling industry.

Some of the forces leading to change

In the 1930's and earlier, the meat packer, relatively speaking, was in a superior competitive position. At this time packers were relatively few in number and, on the buying side, faced a host of less well-informed producers. On the selling side, they faced a large number of relatively small volume retailers who also were less well-informed than packers concerning relative values and qualities of meat. The large volume packer, with a national distributing system, private sources of information, and an economic research department, enjoyed, under these circumstances, a particularly favorable situation.

After 1940, a variety of factors tended to facilitate entry of firms into the industry and to increase the elasticity of the supply responses of small firms.[20] These included numerous technological innovations. Continuing

[19] In addition, sales of breakers to jobbers indicate some double counting in Census data on sales of independent wholesalers. Adjustments in the data presented in Table 6 for estimates of double counting, however, do not substantially change the results and do not invalidate any of the statements made.

[20] This suggests that Hoffman may have underestimated the significance or ignored the application to the meat industry of several other of his statements. In commenting on the importance of the elasticity of supply for small firms in a dominant firm industry he said: "If the (small firms) respond to an increase in price by the large

improvements in transportation and refrigeration, for instance, tended to narrow the competitive lead of the national packer and may have aided the independent wholesaler in that the improvements probably contributed importantly to the decline of the packer branch house. Wartime demands for meat, the compulsory federal grading of beef, veal, and lamb, and wider distribution of market news information provided the independent packers and wholesalers with additional opportunities.

Despite the opportunities presented, the advantages born of wartime conditions might have been transitory if (1) the Korean conflict had not led to a second period of mandatory federal grading, (2) retail food chains had not grown greatly in number and importance during the 1940's and early 1950's, (3) the retail chains had not shifted almost *en masse* to the purchase of beef and lamb on a uniform federal grade basis, and (4) many chains had not begun to merchandise these meats by their federal grade names.

These developments tended to further alter competitive relationships within the industry and to add economic support to changes already under way. Packers soon found themselves dealing with a few astute and knowledgeable food chain buyers who in the aggregate purchased upwards of 40 per cent of the meat sold at retail.[21] This tended to reduce bargaining advantages of all packers, but it added substantially to the volume potential of independent packers. Retail chain buyers preferred to buy at and receive shipments directly from packing plants and were not interested in tying themselves to one or a few packers. National packers, meanwhile, remained encumbered with national distributing systems tailored specifically to the needs of the independent retailer and to sales through branch houses and an army of route salesmen.[22] Sales of national packer branches, in consequence, continued to decline.

Throughout the war and postwar periods, knowledge among retail buyers and others of the official grade standards and grades was increasing. The chain buyer, being interested in the mass retailing of uniform items of standardized quality, began to formulate his own grade and quality specifications. Large numbers of chain buyers followed by considerable numbers of other retail buyers and many dining establishments

firm with a sharp increase in output, then a restrictive policy on the part of the large firm will result mainly in its losing part of the market. . . . Ease of entrance into a particular industry would (also) . . . tend to influence the nature of the supply response on the part of small firms. In a sense, the very existence of numerous small firms indicates that the entrance of new firms is not difficult." *loc. cit.*, p. 83.

[21] "Multiunits" as defined by the Census Bureau accounted for 38 per cent of the meat distributed through grocery stores and meat markets in 1948. See Willard F. Williams, *op. cit.*, p. 15.

[22] The tendency observed by Nicholls of national packers to sell principally to independent retailers continues to exist although less marked. See William H. Nicholls, *Imperfect Competition Within Agricultural Industries*, The Iowa State College Press, 1941, pp. 179-80.

began insisting upon buying beef and lamb stamped with federal grades rather than packer brands. The federal grade standards together with their widespread adoption provided all packers with a nationally recognized certificate of quality for beef and lamb and, therefore, provided independent packers with a national rather than strictly local or regional markets. Furthermore, it caused a marked depreciation of the value to national packers of their packer brands on fresh meats.

The vigorous growth of independent wholesale distributors seems to stem mainly from four interrelated circumstances. These are (1) the increasing consumption of meat in hotels, restaurants, and other dining establishments, (2) the growth of independent shipper type packers in surplus meat producing areas who often rely upon independent wholesalers in deficit areas for distribution of their products, (3) the increased degree of specialization by independent packers, and (4) the growth of retail food chains. For many reasons, the chains buy large quantities of beef and some other meats in the form of wholesale cuts from breakers.[23] These breakers are also important suppliers of the jobbers or hotel supply houses. But as the demand for services has grown and as the independent packer has divested himself of particular functions, mainly breaking and fabricating, these services and functions have been performed to an increasing extent by the independent wholesaler.

Some effects and implications

The effects of the structural changes in meat wholesaling are many and varied. Space permits mention of only a few. Of primary importance, perhaps, are the effects on pricing efficiency, on the nature of competition in the industry, and on intrafirm economic relationships.

Increased use of uniform grade standards and additional market news information together with more widespread use of this information have tended to increase and to equalize levels of knowledge throughout the industry. In addition, and perhaps more important, these changes have tended to eliminate variable quality as a factor in the bargaining process. In turn, these developments along with reduced levels of centralization and concentration have led to an increased degree of competition in the industry and have tended to center competition on price. The industry has become more atomistic and endowed with more of the attributes of the perfect market. In accordance with the presumptions of most econo-

[23] Packers tend to use breakers as large volume outlets for beef carcasses that will not meet the carcass specifications of the chains. The breaker, in turn, sells ribs and loins mainly to the jobbers who supply the restaurant trade and the remaining cuts principally to retailers including chains. Undesirable carcass characteristics frequently do not affect the desirability to chains of particular cuts from these same carcasses. Hence, chains often shop for cuts which they frequently can buy at prices below the prevailing equivalent carcass prices. In addition, most retailers often find it necessary to buy extra quantities of particular cuts.

mists, this appears to have resulted in improvements in pricing efficiency.[24]

Adjustments by firms, in response to changed competitive conditions, are being required, and adjustments by firms in a dynamic economy lead to additional counter-adjustments. In the meat wholesaling industry intrafirm adjustments have affected among other things: numbers of establishments, location, composition and volume of products produced, and buying, selling, and merchandising practices. Some national packers, for instance, have ceased packing operations at various locations, and many have tended to shift their operations to products which lend themselves to branding. Both national and independent packers have been seeking cost reductions through specialization, automation or other means. Additional counter measures by the national packers have taken various forms. These include efforts to set aside the consent decree which prohibits a few national packers from engaging in retailing activities, decentralization of the decision making process through establishment of regional offices, and massive merchandising programs designed to promote and expand the sale of branded frozen meat products.

Other intrafirm adjustments took the form of integration. For a time, chains as well as packers were induced, in the West particularly, to begin integrating back toward the producer level by acquiring feedlots and feeder cattle. Merchandising policies of retail chains had resulted in general increases in the quality of beef sold at retail in deficit as well as surplus feed areas. Integration in the West, a feed deficit area, stemmed mainly from the desires of packers and food chains to assure themselves of regular and continuing supplies of high quality beef. However, the growth of independently owned commercial feeding establishments also was stimulated. As the supply of high quality beef has increased in the West, the trend toward backward integration by packers and chains appears to have come to a halt, and at least in some areas, to have been reversed.

Independent packers have become not only more interested in maintaining plant volume at or near capacity but also in returns to scale. Thus, the structural developments which have taken place do not mean that increases in the scale of operations in the meatpacking industry are associated with negative returns. They do mean, however, that they must be obtained in a different manner and on a different basis than formerly and that national, as well as some independent packers, may be faced with the necessity of more thoroughly readjusting their operations to changed conditions.

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[24] It may be argued that the current tendency toward specialization tends to limit competition. Thus far, however, specialization has principally taken place among independent firms of which there usually are a relatively large number in local markets. This has tended to minimize the effects on pricing efficiency while, at the same time, tending to further alter competitive relationships in favor of the independent firms.

THE FAMILY FARM AND THE LAND SPECULATOR: REFLECTIONS ON A MUCH WORKED THEME

E. Louise Peffer
Stanford University

"A QUESTION which appears puzzling at first is why the family-sized farm has become the leading type in Iowa instead of the large-scale or corporate farm," wrote W. G. Murray in his contribution to *A Century of Farming in Iowa, 1846-1946*.[1] The observation was prompted by the statistics of public domain land disposal in Iowa. Only 900,000 of the 35,800,000 acres of land area in the state were patented under the Homestead acts. Grants for education and internal improvements, including grants to railroad corporations, accounted for 8.8 million acres. Around 12 million acres were sold for cash, and 14 million acres (close to 40 per cent of the total) were located with military bounty scrip, chiefly by "corporations, land companies, and individual capitalists." During the 1850's, eight holdings were acquired that ranged in size from 78,000 to 250,000 acres.[2]

The land laws which made such acquisitions possible applied of course in the other public land states. With the single exception of the Pre-emption acts, no general public land law prior to the passage of the Homestead Act in 1862 placed an upper limit on the amount of public land a person or corporation might obtain. None of the existing laws were repealed by the Homestead Act. Other laws, particularly the liberalization of military bounty land awards, the swampland grants to states in the 1850's, and the land grants to railroad corporations and, under the Morrill Act of 1862, to states for support of agricultural and mechanical colleges, extended the opportunity for people of means to amass large holdings. Of an estimated 400 million acres of public lands alienated between 1862 and 1900, the Homestead Act accounted for only 98 million.[3]

In face of such evidence and repeated attempts to underscore it,[4] it is puzzling still to encounter from time to time the belief that the Homestead Act was responsible for the family farm as the most characteristic farm unit in the United States. A possible explanation of the persistence of this belief is that, although less than 30 per cent of the public lands that passed

[1] W. G. Murray, "Struggle for Land Ownership," in Iowa State College and Iowa Agricultural Experiment Station, *A Century of Farming in Iowa, 1846-1946* (Ames, 1946) pp. 5-7.

[2] *Ibid.*

[3] Computed from U.S. Dept. Comm., Bur. of the Census, *Historical Statistics of the United States, 1789-1945* pp. 119-21; E. Louise Peffer, *The Closing of the Public Domain: Disposal and Reservation Policies, 1900-50* (Stanford, 1951), p. 347.

[4] Notably by P. W. Gates, so frequently as to make a listing of specific citations almost a record of his entire printed output. For that reason only one title is given: "Research in the History of American Land Tenure," *Agricultural History*, July 1954, p. 124.

into private ownership did so under the Homestead Act, most of that occurred in the first two decades of the twentieth century, within memory of living man, when there was far greater activity under the Homestead acts than under any of the other disposal laws.[5]

The family farm antedated the terms, the Homestead Act and the United States. It was the typical farm in colonial New England and it was prevalent also in most of the other colonies despite the conspicuous place of the large estate in historical accounts of the Chesapeake and South Atlantic colonies. In the first decades of England's colonial experience, grants to individual settlers, as distinguished from proprietary or company grants, were on the whole not lavish. Unlike the Spaniards, who ruled their American empire as conquerors, the English were colonizers. Necessity forced them to be. They did not find in the part of the continent in which they established themselves the large concentrations of domiciled Indians, inured to servitude by centuries of subjugation, that made it possible for the Spaniards to consolidate their conquest of the mountainous backbone of the hemisphere from Mexico to Chile. The English had to bring in people in sufficient numbers to hold their territory against other claimants and to provide a labor force. Land was the lure used to attract them, as settlers, as tenants, or as contract laborers, although not in the present connotation of the term. In order to overcome one of the deterrents to emigration, land was also used to subsidize transportation costs. A tract of land, 50 acres or more, was offered for, not to, each person who arrived in the colony for residence. Since few were able to put up their own passage money, the immediate beneficiaries of the system were usually merchants and sea captains who contracted to transport the emigrants. At the end of each passage, they collected warrants or headrights, entitling them to receive for each person delivered the amount of land specified in the offer. They either sold the warrants at a small profit or located them and held the land for later sale at appreciated prices, usually to planters desirous of enlarging their holdings, a practice which soon developed into a profitable speculative sideline for many engaged in various aspects of the trans-Atlantic trade.[6]

What was there in the headright system to induce poor men to pull up

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[5] Peffer, *op. cit.*, pp. 134, 167; Marion Clawson and Burnell Held, *The Federal Lands: Their Use and Management* (Baltimore, 1957), p. 26.

[6] R. A. Billington, "Origin of the Land Speculator as a Frontier Type," *Agricultural History*, Oct. 1945, pp. 204-08; W. F. Craven, *The Southern Colonies in the Seventeenth Century, 1607-1689: A History of the South*, Vol. I (Baton Rouge, 1949) pp. 128, 175, 191-92, 209, 219, 345; C. P. Nettels, *The Roots of American Civilization* (New York, 1935), pp. 135, 140-41; A. E. Smith, "The Indentured Servant and Land Speculation in Seventeenth Century Maryland," *American Historical Review*, April 1935, p. 467, 470; Stella H. Sutherland, *Population Distribution in Colonial America* (New York, 1937), 189-91; T. J. Wertenbaker, *The Planters of Colonial Virginia* (Princeton, 1922), pp. 45, 312, 326-27.

stakes in the old country to start afresh in the new? They believed that the amount of land specified in the headright warrant would become theirs upon completion of the period of indentured servitude to which many of them bound themselves in order to pay off their passage money. Once they learned that the headright implied no such guaranty, it was difficult to hold them to their contracts. Faced with loss of the labor force, the colony or the planters, usually the former, had no alternative but to reward their expectations. As a colonizing device the headright proved to be so effective that in some extent it was adopted by most of the other English colonies.[7]

So it was that the system which gave rise to the tradition that a man could obtain a farmstead in America in return for his labor and sacrifices, "the American dream,"[8] also enabled prosperous planters to build up landed estates, until they developed other less costly means, legal or otherwise, of accomplishing the same end.

One wonders why, with so much opportunity then and later for the enterprising and financially privileged to acquire big estates, there did not develop in the United States the enormous, and for centuries inert, latifundia that have predominated in the land tenure pattern of much of Latin America.

The conventional explanation of the concentration of the best land of Latin America in the hands of relatively few families is that the prestige value of land that prevailed in the Iberian Peninsula, as in the rest of Europe at the time of the discovery of America, was perpetuated in Latin America. In this respect, however, there was little difference between Spanish and English settlers. Many North American colonists were as eager as the Spaniards to acquire big holdings, except that the former were much less prone to look upon land as wealth in the sense that diamonds are wealth. As a later French visitor remarked: "It is not in order to hoard that the Americans are rapacious."[9]

Land was regarded as a source of wealth to be put to productive uses, the more profitable the better. Expectations of profits through resale of the land came to be a prime motive in acquiring large acreages.

As Negro slaves became more freely available in the second half of the seventeenth century, they reduced the dependence of plantation owners on headright servants, who at best formed a labor pool in constant need of replenishment. And the flow of white immigrants into the Chesapeake

[7] Craven, *op. cit.*, p. 177; Marshall Harris, *Origin of the Land Tenure System in the United States* (Ames, 1953), pp. 194-96, 207-08.

[8] T. J. Cauley, *Agriculture in an Industrial Economy: The Agrarian Crisis* (New York, 1956), p. 144.

[9] Duc de Liancourt, quoted in Henry Adams, *The United States in 1800* (New York, 1955), p. 119.

area and the newer colonies to the south began to slacken.[10] This did not mean that the lure of American land was not as strong as before, given conditions and opportunities that were more attractive than the slave labor setting which was emerging on the Southern seaboard. This was demonstrated when William Penn promoted settlement of the American domain granted him in 1781 by offering land and a haven to the religiously and politically persecuted of Europe.

Penn's promises and the ease with which would-be emigrants could contract for passage led to a flow of settlers such as the Americas had not seen before. Many of the first "redemptioners" discovered after they had worked out their contract terms that the expectation of obtaining land in Pennsylvania was slim. Penn had made large grants and sales to English Quakers, and in addition had stipulated that no settlement was to be made in any region of Pennsylvania to which Indian title had not been peaceably quieted, with the result that there was not enough land to go around.[11] What happened then was to become one of the most familiar manifestations of frontier settlement: a movement of squatters onto uncultivated land, whether granted or Indian, that they claimed as their own by right of occupancy and prior promises.[12]

The ensuing frictions might have been intensified had not the leaders of Virginia and Maryland hastened to attract the malcontented. Here was another opportunity to add to their own properties, both in extent and in value, by assuaging the disappointments the newcomers had encountered in Pennsylvania. Prominent citizens obtained from the colonial assemblies free grants of manorial proportions on the frontier upon declarations of intention to settle and develop them. The grantees continued the work of recruitment from the other colonies and abroad that Penn's efforts had proved to be so effective. Land was offered for sale or for lease, with the option made familiar under the system of indentured servitude whereby, in return for a period of service spent in clearing land and beginning cultivation, the farmer would receive a tract of unimproved land of his own. As a result, the number of small farms along the frontier of settlement multiplied, while a beginning was made in clearing the land retained by the grantees for later development themselves or for sale.[13]

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[10] Harris, *op. cit.*, p. 196.

[11] *Ibid.*, pp. 237-41; Sutherland, *op. cit.*, pp. 140-44; S. W. Fletcher, *Pennsylvania Agriculture and Country Life, 1640-1840* (Harrisburg, 1950), pp. 12-15.

[12] Fletcher, *op. cit.*, p. 20; A. T. Volwiler, *George Croghan and the Westward Movement, 1741-1782* (Cleveland, 1926), pp. 237-38.

[13] J. D. Barnhart, *Valley of Democracy: The Frontier versus the Plantation in the Ohio Valley, 1775-1818* (Bloomington, 1953), pp. 5-7; Carl Bridenbaugh, *Myths and Realities: Societies of the Old South* (Baton Rouge, 1952), pp. 138-39, Craven, *op. cit.*, pp. 210-11.

It is difficult to say why this type of enterprise was called speculation. Paul W.

The variation of the headright used by the Virginia and Maryland promoters to people the back country, and at the same time to profit from it, produced such a response that other colonies hastened to adopt it. Even the town proprietors of New England became infected with the speculative urge.[14]

Land speculation had captured the imagination of the colonists and was to be one of the typical aspects of the independent nation they established. It was not restricted to the rich and mighty. Observing the benefits that accrued to big holders through their ability to cater to the market for small farmers, the hardy characters who peopled the frontier strip were fired with the desire to share in possible gains; as often as not the squatter who ventured onto ungranted land was not in search of a farm but of a speculative stake.

> For better or for worse the speculator . . . was present on every frontier. He affected every phase of western development and left in all places his indelible mark. His motives and his deeds one may deplore, but so characteristically American was he, so dynamic a part did he play in shaping land and cultural patterns that it is difficult to imagine an American frontier without him.[15]

These are kinder words than many have used to describe the land speculator and his activities on the American frontier. "By scheme and trickery the government was defrauded of much of its land," writes one critic of their activities, who continues:

> Theoretically, the lucky, industrious, thrifty settler reaped the rewards of his honest laudable efforts. In practice the unscrupulous, the cunning, the hoggish, and the downright scoundrels were the ones who as often reaped the rich harvest from a bountiful, developing virgin region.[16]

Despite a reminder that "hasty and pellmell outpouring of native land grabbers and foreign immigrants" could not have produced "a seasoned economic development upon lines of careful planning with due regard to costs, prices, and return to labor and investment,"[17] the assumption of many critics of speculative activity in connection with public land dis-

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Gates has noted that, while the "term 'land speculator' meant different things to different people and different sections," the following general meaning has applied: "All persons seeking land for investment rather than for a farm home have been called land speculators, and the term loose as it may be, has an important position in our terminology."—P. W. Gates, "The Role of the Land Speculator in Western Development," *The Pennsylvania Magazine of History and Biography*, July 1942, p. 314.

[14] R. H. Akagi, *Town Proprietors of New England Colonies: 1620-1770* (Philadelphia, 1942), p. 177 and *passim*.

[15] P. W. Gates, "The Role of the Land Speculator . . . ," p. 333.

[16] Everett Dick, *The Dixie Frontier* (New York, 1948), pp. 334-336.

[17] E. G. Nourse, *American Agriculture and the European Market* (New York, 1942), p. 28.

posal seems to have been that the pace of settlement could have been controlled. Burke's often-quoted warning to the British Parliament in 1775, when it was contemplating means to control the far-ranging habits of American frontiersman, bears another repetition: "You cannot station garrisons in every part of these deserts. . . . Many of the people in the back settlements are already little attached to particular situations. . . . [They] behold before them an immense plain, one vast, rich, level meadow . . . Over this they would wander without a possibility of restraint . . ."[18]

Actually, the Founding Fathers, many of whom had been infected by the speculative virus but had become appalled by its excesses, modeled the system first adopted for disposition of the public domain on the New England town, in the hope that order would be introduced into the pattern of settlement and time afforded for quieting Indian titles. No land was to be opened for entry until after survey; unsurveyed and Indian lands were declared off limits. One can imagine what might have happened if settlement had proceeded at such a measured pace, with Spain to the south and west, and with England's trading empire to the north desiring no encroachment into the territory of its Indian trading partners of the Ohio Valley. The western boundary of the country might never have advanced beyond the line established by the treaty of peace with England. Conceivably the boundary could have been pushed back to the Appalachians, or independence lost altogether.

Because mid-Western frontiersmen refused to be confined in their movements by the cautious settlement blueprint which Congress had drawn up for its public domain, fingers of settlement began to penetrate Indian tribal lands. This sparked a wave of reprisals, to which it was suspected that the English gave unofficial blessing reinforced by guns. Spain began to lure settlers to its trans-Mississippi territory with liberal grants of free land on a headright basis and at the same time antagonized settlers in the eastern Mississippi Valley by closing the mouth of the river to their traffic and commerce.[19] The disgruntlement of the frontiersman was directed as much toward his own government as toward the foreign powers and forced the United States to tests of strength for which it was ill-prepared. The result was that the sovereignty of the new government over its western territory was successfully maintained. Its western and southern boundaries were so extended that the government had a breath-

[18] Edmund Burke, *Two Speeches on Conciliation with America* (London, 1889), p. 134.

[19] Dorothy A. Dondore, *The Prairie and the Making of Middle America: Four Centuries of Description* (Cedar Rapids, 1926), pp. 121-122, 123; L. C. Gray, *History of Agriculture in the Southern United States to 1860* (New York, 1941) pp. 164-165; J. N. Primm, *Economic Policy in the Development of a Western State: Missouri, 1820-1860* (Cambridge, 1954), p. v.

ing spell of several decades in which to consolidate its position before the expansive activities of its irrepressible "land grabbers" forced it to extend its jurisdiction farther.

These intrepid heroes of an earlier school of historians are now charged with having inhibited settlement, with having caused it to spread too rapidly across the face of the land, and with having perverted the intent of the land laws:

> The government's liberal land policy was ostensibly designed to favor the bona fide settler and lower-income groups on the farm and in the city. But, although the policy did encourage rapid settlement, it did not encourage permanent settlement; and it benefited speculators much more than the city laborers and low-income groups whom land reform leaders had in mind.[20]
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> Ostensibly, the land policies were intended to benefit agriculture, but history bespeaks the fact that they were geared to meet the interests of the railroads, the speculators, the politicians, and others, which in the final analysis worked irreparable damage to farming.[21]

Public land policy was based on two precepts: the land was "to be considered as a common fund for the use and benefit of the United States . . . ," and new states were to be created from it.[22] The laws by which these precepts were translated into policy were, by the very nature of the legislative process, compromises between the interests of the several sections, and between different interests within the same section.[23] It was a settlement policy, although the government initially had no intention of serving as a settlement agency. Men of means were expected to perform that function as they had done in the colonial period. The success of the colonial system, however, had been based on free grants of land. At the outset of the federal period, the minimum amount of public land that one person could buy was 640 acres, at $1 an acre; he could buy as much more as he desired and could afford, but only in alternate sections.

From the standpoint of the lower-income groups, the policy of using the public domain as a source of revenue was not liberal. No longer could a poor man expect, as in colonial times, to obtain a farm of his own through a term of years and hard labor. Prior to the passage of the Homestead Act only military land bounties enabled individuals to obtain land without cash payment. Yet by exacting a price for its lands, Congress did more to prevent early and possibly permanent engrossment of large areas by a privileged few than by any subsequent relaxation of the land laws in the interest of small settlers. Members of the land-owning class, who

[20] Herman E. Krooss, *American Economic Development* (New York, 1955), p. 112.

[21] Theodore Saloutos, "The Agricultural Problem and 19th Century Industrialism," *Agricultural History*, July 1948, p. 160-161.

[22] *U.S. Supreme Court Reports*, 42-45 U.S., 3 Howard 212.

[23] Barnhart, *op. cit.*, p. 199.

had formerly been able to enlarge their own estates by sponsoring settlement of small farmers, were virtually excluded from the market because they usually lacked liquid assets. As a rule only the commercial and professional classes of New England and the Middle States, who at that time found land to be the best form of investment, had the ready cash to pay the prices the government asked, and most of them bought with a view to resale. Even they were reluctant to buy when the price was raised from $1 to $2 in 1896.

It was the price of public lands, not the big speculative holdings, that accounted for the rapid fanning out of settlers across the face of the land. By present reckoning the price was not high, but for untamed land it was beyond the means or the willingness of the poor man to pay, especially since there was no assurance that the minimum price would prevail in the public auctions at which surveyed lands were first thrown upon the market. The enterprising therefore moved onto unsurveyed and unoffered land in the hope of earning enough by farming, speculation, or sheer chance to be able to buy it when it was opened for sale. Speculative holdings were often bypassed if they were treeless, if a more lively scene of speculative activity lay beyond, if they were not close to main traveled routes, or if friends of prospective buyers had not already settled there.

To an extent that is impossible to document, but which in some locations and some periods must have been considerable, the frontier advanced well ahead of surveys.[24] One is inclined to wonder if, in the public land states admitted prior to 1860, squatters did not outnumber land owners in the population quotas required for statehood.

While the squatter-speculator[25] was pushing the frontier farther ahead, there was occurring behind it the orderly advance of settlement that speculators are accused of having thwarted. Well-to-do Eastern farmers began to buy up land beyond the mountains quite early. There was always a thin stream of European immigrants, although they ceased to be the dominant frontier force after the colonial era. Among them were farmers of some wordly substance in the Old World; others lacked the means to buy outright and remained in the older states until a stake had been acquired to enable them to move farther west.[26] They wanted farms, not the wild land of the frontier, and preferred to settle where the soil and terrain most resembled conditions with which they had been familiar at home. Among the native-born land-seekers were always men of modest means and conservative tendencies whose preference was for farms of manageable size so located with respect to established markets that they could hope to derive their profits from the sale of their farm produce

[24] Murray, *op. cit.*, p. 2.
[25] Everett Dick calls him "the professional squatter"—*op. cit.*, pp. 54-55.
[26] Oscar Handlin, *The Uprooted* (Boston, 1951), p. 82-85.

rather than from the sale of their farms. Among them the so-called land speculators found their customers, because speculators were the most certain source of credit throughout the years of greatest land activity.[27]

The only real attempt of the government to provide credit for purchase of public lands was the Harrison Land Act of 1800 which allowed a minimum of 320 acres (reduced to 160 in 1804) to be bought at $2 an acre, with payments spread over a period of four years. It spurred such a wave of speculative buying—the speculation taking the form of hope that the future would turn up the cash to complete the payments—that the Congress was forced several times to postpone the date of final settlement. The Harrison Act was repealed in 1820, and thereafter cash payment at the minimum rate of $1.25 per acre was required for all public lands subject to sale, with the exception of tracts that had remained unsold for years.[28] Although the size of the minimum tract was reduced to 80 acres in 1820, and to 40 acres in 1832,[29] many small farmers continued to buy from land companies because of the credit allowed. The prices they asked were not necessarily as extortionate as may be inferred from the diatribes against them, but they could usually expect to receive better prices for smaller than for larger tracts.

Generalizations as to the adverse effects of speculation in public lands imply a sustained intensity of demand that speculators exploited to the hilt. Prior to 1860, this was not the case. Only in the Gulf states of the South was the demand for land constant, in response to requirements of the expanding cotton textile industries of England and New England. In the country as a whole there were four waves of speculative frenzy in western lands,[30] and from time to time localized frontier booms occurred, all of which revealed the speculator at his predatory worst. For the greater part of the time and in most localities the fortunes of speculators were determined by the central fact of the frontier advance: there was more land than customers. Between locations and, later, sections, the rivalries of speculators were keen, and the lulls between waves of speculation heightened efforts to attract settlers.

The scale was weighted more heavily in favor of the buyers as Eastern investors, whose expectations of huge profits had been squeezed between resistance to prices and flagging demand, became eager to withdraw from their ventures in western lands, even at a loss, in order to put their money into more promising commercial and industrial enterprises elsewhere.

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[27] Billington, "Origin of the Land Speculator," p. 211.

[28] B. H. Hibbard, *A History of the Public Land Policies* (New York, 1939), pp. 82-84, 87-98, 104, 112.

[29] *Ibid.*, p. 75.

[30] Hibbard, *op. cit.*, pp. 100, 103, 106, 114, 214-26; R. A. Billington, *Westward Expansion: A History of the American Frontier* (New York, 1949), p. 731.

Counties also became better able to enforce their tax claims against absentee owners.

Land companies and big speculators soon learned that if they were to obtain prices higher than they had paid for their land, they would have to contribute added values. Some laid out towns, not primarily from altruistic motives since sale of town lots afforded a lucrative form of speculative profits; but to the extent that they were successful, they created local markets for settlers' crops until more remote markets were made accessible. Some built flour and saw mills. Land agents were instrumental in organizing churches and schools. By such enterprises, crude though they were, they helped break down the isolation that was one of the greatest hardships the pioneer family had to endure. On a wider plane, speculators have been given the credit for sparking the movements that induced Congress to enter upon the program of internal improvements that provided communications links with the more heavily populated region to the east and to the ports connecting the Mississippi Valley with the world.[31]

In consequence of the processes of frontier speculative activity and post-frontier development, settlement in the public domain states[32] had proceeded at such a pace by 1850 that six states—Ohio, Indiana, Illinois, Alabama, Missouri, and Mississippi—were among the top 15 in population. Ohio had stepped into fifth place in 1820, fourth in 1830, and third in 1840, a rank it was to hold until 1890. Indiana was in seventh place in 1850. In density of population, Ohio stood ahead of any of the South Atlantic states and Indiana ranked higher than all of them except Delaware.[33]

Of the trans-Mississippi states, only Missouri and Louisana had populations in excess of 500,000. California and the Southwest had just been added to the sparsely settled western expanse, and the expansionist forces reacted as nature does to a vacuum. Congress was overwhelmed with petitions for a more liberal disposal policy, and succumbed in a series of enactments already detailed, which made it possible for capitalists to accumulate enormous properties. Of an estimated 800 million acres of public land disposed of after 1850, the Homestead acts accounted for around one-third.

As for the poor man, the Homestead Act was not as liberal as it is sentimentally believed to have been. It revived the principle of the headright system that enabled a settler to earn a farm by an investment of years, five at the outset, and some labor. But farming conditions had changed.

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[31] Larry Garra, *Westernized Yankee: The Story of Cyrus Woodman* (Madison, 1956), pp. 33-35, 37; Billington, "Origin of the Land Speculator . . . ," p. 211.

[32] All except the 13 original states, Maine, Vermont, West Virginia, Kentucky, Tennessee, and Texas.

[33] *Statistical Abstract of the United States*, 1904, pp. 15-25.

In addition to land, a poor farmer needed cash or credit to make a start. He could not mortgage his homestead claim, but he could pre-empt it (or commute it to cash—a synonymous term) by buying it for $1.25 an acre, usually with an advance from a bank or agent, which thereupon took a mortgage to the property.

The commutation clause of the Homestead Act was singularly adaptable to fraudulent use, and the opportunity was not overlooked. It is not correct to say, however, that

> Under the Homestead Act, . . . more land was pre-empted than was given away, and most of the pre-emptions were by speculators who obtained large areas by filing claims in the name of innumerable dummies. In the 1890's William S. Chapman owned over one million acres in California and Nevada. William Scully owned 250,000 acres in the Middle West, and the Miller and Lusk ranch in California covered 450,000 acres.[34]

Of the 286 million acres patented under the Homestead acts, less than 13 per cent was pre-empted after entry.[35] Properties of the magnitude listed were not built up in their entirety through perversion of the pre-emption principle. Dummy homestead entries, later commuted, were resorted to by ranchers to gain control of water holes and banks of streams, or to protect fence lines,[36] but only to the extent necessary to discourage encroachment by homesteaders on areas of public range to which ranchers had established use. There were other easier and generally cheaper means of acquiring unimproved land than by paying $1.25 an acre for it in quarter-section parcels. For example, Chapman acquired 210,000 acres with college scrip and Miller and Lux, 79,000 acres.[37] It is even questionable whether most pre-emptions that did occur were speculative in intent. The profitability of the mortgage lending business and the high interest rates that buyers were willing to pay do not suggest the speculative type of borrower.[38]

To attribute the expansion of agriculture after 1850 to the influence of land speculators and other special pleaders on Congress is to overlook other aspects of the movement. Criticisms of the grants to railroads for overstimulating the advance of settlement do not take into account that it was the railroads, not the grants, which had that effect. Such expansion of cultivation as took place as a result of land sales by the railroads would

[34] Krooss, *op. cit.*, p. 113.

[35] U.S. Dept. Int., Bur. Land Management, *Report of the Director, 1955. Statistical Appendix*, pp. 119-20.

[36] A. R. Reynolds, "Land Frauds and Illegal Fencing in Western Nebraska," *Agricultural History*, July 1949, p. 173.

[37] P. W. Gates, *The Wisconsin Pine Lands of Cornell University* (Ithaca, 1953), pp. 31-32.

[38] A. G. Bogue, *Money at Interest: The Farm Mortgage on the Middle Border* (Ithaca, 1955), p. 272 and *passim*.

have taken place under other land laws if the railroads had been built with private capital, as they would have been shortly in any event.[39] Indeed, so great was the avidity for American land that it is quite likely that the area in farms would have expanded at the same tempo following passage of the general Pre-emption Law of 1841, without further liberalization of the land laws except to enlarge the acreage allowance when settlement reached the Great Plains.

The real explanation of the extension of the farm area after 1850 was an even greater increase in the demand for food and agricultural raw materials. Stimulated by the Civil War and sustained by Britain's free trade policy that deepened its reliance on imported foodstuffs, the expansion received its greatest impetus from the cumulative effect of a population growth which had averaged 3 per cent per annum between 1790 and 1860. Thereafter the relative rate slackened, but absolute increases were greater than ever; the numerical increase in one decade, 1880-90, was only slightly below the estimated population of the country in 1830. From 23.2 million in 1850, the population rose to 105.7 million in 1920. More significant than the total increase was the growth in the urban population, which in 1850 stood at 3.5 million as contrasted with a 19.6 million rural population. The real effect of this development did not begin to make itself felt until after 1890, because to that time increases in the rural count continued to be higher than for the urban sector; the latter stood at 22.1 million in 1890, the former at 40.8 million. By 1920, urban inhabitants had caught up with and passed the rural population in numbers (54.2 million urban; 51.6 million rural),[40] and the steady rise in the purchasing power of the urban and industrial classes accentuated the numerical gains.

In response to these impulses, between 1850 and 1920 (the period that roughly corresponds to the effective life of the Homestead laws) the number of farms in the country rose from 1.5 million to 6.5 million, the greater part of the increase being in the public land states. The number of farms continued to increase unitil 1935 but has declined ever since, although the acreage of land in farms has shown a gradual but steady increase. Part of this is statistical. Public range land long in use is included in the farm acreage but was excluded from the reported farmland total prior to passage of the Taylor Grazing Act. Despite a great increase in farms of less than 20 acres and over 500 acres, the census years for which we have

[39] J. B. Hedges, "The Colonization Work of the Northern Pacific Railroad," *Mississippi Valley Historical Review*, December 1926, p. 311; P. W. Gates, "The Railroad Land-Grant Legend," *Journal of Economic History*, Spring 1954, pp. 144-145; W. S. Greever, "A Comparison of Railroad Land-Grant Policies," *Agricultural History*, April, 1951, p. 85; *Arid Domain, The Santa Fe Railroad and its Western Land Grant* (Stanford, 1954), p. 39; T. C. Cochran, "Land Grants and Railroad Entrepreneurship," *The Tasks of Economic History*, Supplement X—1950, pp. 60-66.

[40] *Historical Statistics*, pp. 25, 29.

comparable data (1900-40) show that from 63-70 per cent of United States farms have been quite evenly and consistently distributed among three size groups: 20-49 acres, 50-99 acres, and 100-174 acres. This concentration of farms in below average size groups should not be used, as it sometimes is, to illustrate the ineffective working of the land laws, or to question the predominance of the family farm in the land tenure pattern of the country.

The family farm of tradition was an operator-owned commercial farm, large enough to support a family and provide some of the amenities of life but small enough to be operated with little more than occasional labor outside of that provided by members of the farm household. Many settlers wanted farms of that type; others preferred larger operations. But preference was no more responsible for the prevalence of the family farm than was the Homestead Act. The abundance of public land and the speculative urge that it first incited made it virtually impossible outside the South for farmers to attract and hold the labor force required to operate larger units. This continued to be the case later when the lure of the city and industrial wages drew off what might have become a surplus farm labor force.

The history of agricultural settlement in the United States is one of constant adjustments of farm sizes to meet the reality of the farm labor situation. Many who entered 320 acres under the Harrison Land Act of 1800 did so with the intention of developing part of the area and speculating with the remainder. Conceivably, however, at least a reasonable proportion of them at first intended to retain the entire tract but found that they could not farm and pay for the whole amount.

Certain vast farming enterprises have always functioned with hired labor and tenants, and western cattle ranches apparently had little difficulty in keeping their hands. Nevertheless, the vast majority of owners of farms larger than the family size unit sold their farms or retained only as much land, in addition to what they could hope to manage without additonal labor, as they could afford to hold under prevailing tax schedules. Iowa provides an example. There the average farm size was 185 acres in 1850; in 1870 and 1880 it was 134 acres. By 1880, the number of farms in excess of 1,000 acres had increased to 428, but these increases were counterbalanced by a pronounced reduction in the 320 acre holdings.[41] By 1925 the number of farms of 1,000 acres and above had dropped to 104,[42] although it was to increase again later in line with the general tendency already noted.

On the other hand, men of limited means who had to pay the asking

[41] Murray, *op. cit.*, pp. 10-11.

[42] U.S. Dept. Commerce, *United States Census of Agriculture*, 1925 (Washington, 1927) I, p. 8.

price bought land only in amounts compatible with their ability to pay. Larry Garra, in *Westernized Yankee: The Story of Cyrus Woodman,* states that in the part of Wisconsin in which Woodman conducted his land ventures, settlers "rarely" entered tracts larger than 40 acres.[43] Enterprising farmers who had started out with small acreages added to them as rapidly as circumstances permitted, up to the limit that members of the farm family could cultivate with available equipment and draft power. And this has continued to be the pattern.

Even with the farm growth after 1850, agriculture was prosperous between 1895 and 1914; this was reflected by high farm prices in the settled parts of the country. Given the inability of the government to control the flow of settlers, it was inevitable that the farm area should have been extended to the limits made possible by the public lands. It was also inevitable that adoption of improved agricultural practices should have been retarded as long as the cost of land was lower than the cost of introducing new techniques. Since 1920, when the public domain ceased to be of much importance agriculturally, the farm population declined to 23 million in 1950, which was little higher than the rural population of 1850. Yet agricultural production has more than kept pace with a more than 50 per cent increase in total population. All of this suggests that agriculture has had ample time to recuperate from any damage that the rapid disposal of the public domain may have caused, and that speculators in public lands and the alleged subservience of Congress to them can no longer be held accountable for the present state of agriculture. Unless of course, they can be held responsible for the continuing prevalence of the family farm, whose recent high productivity a recent writer asserts to be the real problem of American agriculture.[44]

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[43] Garra, *op. cit.,* p. 79.

[44] Carroll Kilpatrick, "The Soil Bank Deserves a Better Trial," *The Reporter,* Dec. 26, 1957, p. 24-25.

SOME CURRENT DEVELOPMENTS IN FUTURES TRADING

ROGER W. GRAY
Food Research Institute
Stanford University

IN RECENT months a great amount of agitation has been manifest concerning trading in onions and potatoes. Committees of both houses of Congress have held hearings over bills designed to prohibit futures trading in the two commodities separately.[1] The onion bill[2] was reported favorably out of the House agricultural committee. Testimony has been heard from growers, dealers, congressmen, representatives of the Commodity Exchange Authority,[3] and members and officers of the Commodity Exchanges, among others. The C.E.A. has conducted special surveys of both markets at frequent intervals and has published the results of these and of their analyses of the markets.[4] Official and unofficial complaints of manipulation on the onion and potato markets have been aired. Formal disciplinary action has been taken against certain individuals[5] as a result of some C.E.A. investigations of these markets, but the same may be said of other futures markets which are not currently under direct attack. The current attacks are spearheaded by the national growers' associations, although it is not clear how spontaneous or widespread the anti-exchange sentiment may be among growers.

The current attack is the most concerted attack undergone by any futures markets in the United States since the grain markets were placed under federal regulation in 1922. Prior to that time, more than 100 bills designed to outlaw or restrict futures trading in the United States had been introduced in Congress, but none had passed. A vast amount of in-

[1] *Cf. Onion Futures Trading, Hearings before a Subcommittee of The Committee on Agriculture and Forestry,* United States Senate, 85th Congress, 1st session, on S. 778 and S. 1514, August 12, 1957, and *Futures Trading, Hearings before a special Subcommittee of the Committee on Agriculture,* House of Representatives, 84th Congress, 1st session at Presque Isle, Me., December 6 and 7, 1955.

[2] H.R. 376, 85th Congress, 1st session.

[3] Hereinafter abbreviated to C.E.A.

[4] *Cf.* the following publications of the C.E.A.:

(1) *Onion Futures: Survey of Open Contracts on the Chicago Mercantile Exchange,* May 31, 1956
(2) Same title, October 31, 1956
(3) Same title, December 31, 1956
(4) *Speculation in Onion Futures,* January-March 1957
(5) *Futures Trading in Onions,* December 1956
(6) *Potato Futures: Survey of Open Contracts on the New York Mercantile Exchange,* October 31, 1955
(7) Same title, June 29, 1956
(8) *Futures Trading in Potatoes,* 1954-55, November 1955.

[5] *Cf.* C.E.A. Dockets Nos. 68 and 69, as summarized in Rodger R. Kauffman, Administrator, C.E.A., *Recent Developments in Futures Trading under the Commodity Exchange Act,* U.S.D.A., Agr. Info. Bull. No. 155, June 1956.

formation was collected and analyzed by the Federal Trade Commission[6] preparatory to federal regulation of the grain markets, and subsequently other future markets were brought under surveillance. The regulatory function itself has entailed continuous data collection and occasional full-scale investigations, with the result that there now exists a substantial amount of published information on futures trading, which provides a foundation for improved understanding.

The purpose here is to show that, in spite of this accumulation of information, the current controversy has been clouded by ambiguity, inconclusive statistical analyses, and incantation. The diversity of hearings testimony and other published materials which carry the present controversy precludes a rigorous statement of the argument, which is polymorphous, against trading onion and potato futures. The best that can be done is to allude to the predominant or recurrent themes, which, it seems to me, are the following:

(1) There is too much speculation in these futures (or the markets are too speculative).
(2) Price variability is too great and is caused by futures trading.
(3) Onions and potatoes are perishable commodities, and are therefore not adapted to futures trading.

The Ambiguity: I. Definition and Measurement

In order to show that these markets are too speculative, it becomes necessary to define and measure speculation. An unambiguous definition of speculation, if by this is meant a definition which draws a sharp line between *positions in futures markets* which are speculative and those which are hedging, is not easily had for the reason that many such positions contain elements of both hedging and speculation. A definition of hedging which has proper regard for the business uses of futures is that provided by Working: "Hedging in futures consists of making *a contract to buy or sell on standard terms, established and supervised by a commodity exchange, as a temporary substitute for an intended later contract to buy or sell on other terms.*"[7] Many such contracts contain elements of speculation; in fact, many are undertaken for purposes other than reducing risks. Moreover, many such contracts are classified as speculation in the published reports of the C.E.A. The importance of this ambiguity varies with the prevalence of the more speculative sorts of hedging in different markets; in the potato and onion markets much of the hedging is partly speculative. Shippers, dealers, merchants, brokers, and processors,

[6] Federal Trade Commission, *Report on the Grain Trade,* Vol. I-VII, Washington, 1920-26.

[7] Holbrook Working, "Hedging Reconsidered," *Journal of Farm Economics,* Vol. XXXV, November, 1953.

as well as fertilizer dealers, have many occasions for buying or selling the standard futures contract as a temporary substitute for an intended later transaction in potatoes or onions, *even though the futures contract is not reportable as hedging as an offset to currently held stocks or fixed price sales commitments.*

The importance of this ambiguity in the present context may be suggested in a comparison between onion and wheat futures. For certain markets and dates, the C.E.A. obtained the occupational distribution of speculators. Only one such distribution is available for wheat; three for onions.[8] In the case of wheat futures at Chicago on September 17, 1947, 78 per cent of all speculative positions were held by "outside" speculators, and 22 percent by "industry-connected speculators." The distribution for onion futures, a total for three surveys on May 31, October 31, and December 31, 1956, was 50 per cent "outside" and 50 per cent "industry-connected." Much industry-connected "speculation" is hedging according to Working's definition; yet the greater extent of this category of "speculation" contributes to the impression that the onion market is highly "speculative." On the above dates, 56 per cent of all wheat futures commitments and 65 per cent of all onion futures commitments were designated speculative; yet if only outside speculation is counted, the wheat market was 46 per cent and the onion market 33 per cent speculative. If it is difficult, however, to say how much speculation there is, it is not so difficult as it is to say how much is too much.

The Ambiguity: II. How Much Speculation is Desirable?

One criterion for judging what amount of speculation is desirable is that speculation should be sufficient to create a good hedging market. This criterion, or some variant of it, is implicit in most C.E.A. reports of market investigations, wherein the amount of speculation is appraised in terms of the amount of hedging. But this criterion is not unambiguous. Properly interpreted it is a valid but nebulous criterion; improperly interpreted it is precise but arbitrary. An illustration of improper interpretation of this criterion is found in some of the C.E.A. reports of market surveys, where their comment has been "speculative commitments were far in excess of the amount needed to carry the relatively small amount of hedging commitments"[9] or words to this effect. When, as in this case, a view is taken of the distribution of commitments only, without regard to the process by which they came into being, the amount of hedging *needed* can only be the difference between long and short hedging commitments, which would require that speculators be on only one side of

[8] The wheat data are from *Statement of J. M. Mehl, Administrator, C.E.A., before Joint Committee on the Economic Report*, Nov. 24, 1947 (mimeo); onion data from the first three titles in footnote 4 above.

[9] *Futures Trading in Potatoes, op. cit.*, p. 52.

the market at any time. This criterion is precise, but irreconciliable with the theory and practice of futures trading.

It is not clear from the context in which the C.E.A. statements (to the effect that speculative commitments exceed amounts needed to carry hedging commitments) appear that they intend a strict interpretation of "needs." I have found such statements only in the circumstance that speculative commitments exceeded hedging commitments, which suggests the inference that total (long plus short) hedging commitments need to be offset by an equivalent amount of total speculative commitments (long plus short). This amounts to the same thing as the strict interpretation of needs in the case where hedging is all on one side (and speculation all on the opposite side), but such a distribution would rarely if ever occur. No futures trading is conducted in such a manner as to give rise to the expectation that hedging and speculative commitments would be equal; hence this interpretation of the criterion is arbitrary.

In short, while the criterion that speculation should be sufficient to create a good hedging market is valid, it is not possible to apply this criterion by observing the distribution of hedging and speculative commitments. A proper interpretation of the criterion must take account of the process by which commitments are undertaken and offset, the "best" hedging market being one in which trades can be made with minimum price effect. Hedgers can trust price quotations only to the extent that speculators defend the quotations. When new information renders a quotation indefensible, hedgers need to rely upon speculators to arrive at a new price which is defensible. A large group of speculators continuously readjusting their positions as conditions change (a liquid market) provides the best assurance to the hedger that he can trust the price. This interpretation of the criterion, which is the common "trade" interpretation, is nebulous in that it offers no way of specifying an optimal amount of speculation.

The full extent of the ambiguity may be appreciated in noting that the onion and potato markets have serious limitations in the view of experienced users of the markets as well as in the view of the C.E.A., but from *opposite standpoints*. This is illustrated in interpretations given to the price behavior of the March, 1957, onion contract, which was such as to occasion resurgence of the clamor to abolish futures trading in onions. The price of this contract rose from $1.20 to $1.50 per 50 pound sack in a week in mid-January, reached $1.70 in late January, followed by a peak of $2.20 on February 4, then a steady drop to a low of $.85 on March 6, and subsequent recovery to $1.58-$1.60 as the contract expired. The C.E.A. concluded with regard to this situation that "the wide price swings . . . appear to have been the result of *heavy speculative activity*."[10]

[10] *Speculation in Onion Futures, op. cit.*, p. iv., the writer's italics.

The interpretation given this price behavior by a customer's man in a large commission firm may be contrasted and perhaps partially reconciled with the C.E.A. interpretation. This individual, who has had much experience in handling the accounts of both hedgers and speculators in onion and potato futures, described to me the situation in the March onion contract while it was in progress and before I had been aware that it had elicited keen interest. He had urgently recommended short sales to his speculative clients when the price was above $2.00, but had been unable to place their orders as the price fell precipitously. He recommended purchases at 1.25 and lower and succeeded in placing orders in this range. The price had gone to .98 when I talked with him, but he said that his clients would hold fast, even if it dropped still further, as the statistical position had indicated (to him) a price in the 1.50 range quite consistently. His explanation for the wide swings above and below the equilibrium level was quite simply that there is too *little* speculation in onions. Developments in the statistical position are commonly over-reflected, in his view, because of the paucity of speculation. Further, in his own words, "I can't recommend a trade for a nickel because that trade might move the price a dime."

Reconciliation of the view of too much speculation with that of too little speculation requires reconsideration of what is meant by speculation. Even if all forms of hedging, including the more "speculative," were excluded, the C.E.A.'s conception of speculation includes two different kinds of trading done by two quite distinct groups of traders—professional speculation and public speculation. In speaking of speculation, the habitué of futures markets connotes professional speculation as distinct from trading by the public. The class of professional speculators provides the basic defense of price. Where this class is small, as in the onion and potato markets, a wave of public buying or selling meets little resistance; such a market the trade refers to as a "thin market." A sudden expansion of public participation, such as the C.E.A. found in the March onion contract, appears to them as too much speculation; whereas the experienced trader, thinking of the feeble price defense which was thrown up in this event, diagnoses the trouble as too little speculation.

Less than 10 per cent of the commitments on the dates of surveys of the onion and potato market have been held by the group designated "brokerage firms and employees, floor traders, and professional speculators." This group includes the class of traders that must provide the basic price defense.

Although the views of "too much" and "too little" speculation are at least partially reconciled by taking account of the ambiguity in the word "speculation," this does not mean that either expression points with equal clarity to the defect in these markets. The inadequacy of the type of

speculation which provides price defense owes to the lack of routine hedging in these markets; the emergence of which is the *sine qua non* of highly developed futures trading. From the standpoint of the improvement of these two futures markets there *is* too much speculation, but it is speculation in potatoes and onions, not in futures contracts. Most of the late crops of potatoes and onions go into storage at harvest time and are left unhedged. Growers and country shippers or dealers speculate on the prices of these stored commodities to the extent that the peak levels of open contracts on futures markets amount to less than 10 per cent of the stocks. The price risk in this speculation is inherently very great: movement into consumption channels is not highly coordinated, reporting necessarily lags the fact, and competitive crops are maturing in the south during the out of storage movement. Not only is the hedging *need* pronounced, but the hedging opportunity has been excellent. At potato harvest time (October 15 in Maine, to select a date for a routine hedge) the average carrying charge to February 28 (March future) has been 60 cents a cwt. in the last eight years, and the price of the March future has averaged 40 cents a cwt. higher on October 15 than on the following February 28. Similar relationships have prevailed in onion prices. It may be argued of course that the present market would not maintain this hedging opportunity should most growers and country dealers elect to use it. No theory of futures trading can answer this argument, but the empirical development of major futures markets suggests clearly that the speculators who can and will support these prices will not appear on the scene until such time as this hedging opportunity is seized.[11] Given the development of routine hedging in these markets, the public trading which is deemed excessive would be readily absorbed.

The Inconclusive Statistical Analyses

Futures trading, if it is to be condemned, must be shown to have bad effects. Whether it amplifies or reduces price fluctuations is an important question. The C.E.A. concluded from the onion futures price behavior outlined above that "it is clear that futures trading in onions has widened and accentuated price movements over short periods of time within a marketing season."[12] This particular conclusion has not, surprisingly, been seized upon by the opponents of futures trading in onions. That the price swing was wide is without question, and that it was established through the vehicle of organized futures trading is equally clear; but that futures trading has widened and accentuated such a movement is not demonstrated.

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[11] Specific evidence on this point is contained in Holbrook Working's "Whose Markets?—Evidence on Some Aspects of Futures Trading," *The Journal of Marketing*, Vol. XIX, No. 1, July 1954.

[12] *Speculation in Onion Futures, op. cit.*, p. v.

Two studies have been undertaken to measure comparative price variability in the present context. One was a study by the Agricultural Economics Division of the U.S. Department of Agriculture[13] which showed that cash prices farmers received for onions were subject to significantly greater variability during the 1930-40 period when there was no futures trading than during the 1947-55 period when the futures market was operative; that the percentage variation explained by production and disposable income was larger in the latter period; and that the smaller residuals of the latter period were related to volume of futures trading. The chief reservation which I hold toward these results is that I suspect that the cash onion market has become better organized in recent years, owing to the activity of grocery chains and to increased trucking, whereas there is little evidence of this improvement being closely related to the futures market. These are nevertheless superior results to those which purport to give an opposite indication.

The C.E.A. compared month-to-month variability in onion futures prices directly with farm prices for the 1948-56 period,[14] employing U.S. farm prices, which are a weighted average for all production areas and include all grades and varieties of onions. They concluded that the range of farm prices over the eight month marketing season was a lower percentage of average monthly price in six out of eight recent years than the same computation for the near future in the Chicago onion contract. For the eight month season, the near future is three months away in one month, two months away in two months, one month away in four months, and zero months away in one month. In each of the two years in which the futures price range was a *lower* percentage of its average price, the seasonal low occurred in the month when the near future was three months away and the seasonal high in the month when it was zero months away. In the remaining six years in which the futures price range was a *higher* percentage of its average price, the seasonal lows averaged .5 months away from the near future and the highs 1.5 months away from the near future. Since the futures market reflected carrying charges throughout the period, the comparison made by the C.E.A. is inappropriate, embracing as it does varying amounts of carrying charges in the range of the near future price.

The Incantation

Another concept which figures repeatedly in the hearings testimony is "perishability." In the context of the hearings, the word "perishability" is an incantation, for although the assertion is reiterated that futures trading cannot work for a perishable commodity, no reason is advanced why

[13] Summarized in *Onion Futures Trading, op. cit.*, pp. 50-56.
[14] *Futures Trading in Onions, op. cit.*, pp. 13 and 52.

this should be so. A typical statement regarding perishability occurs in the testimony of John C. Datt, Assistant Legislative Director, American Farm Bureau Federation, who lists perishability as the leading reason for Farm Bureau opposition to futures trading in onions and potatoes and says, "Onions and potatoes by their very nature are perishable commodities. They cannot be stored for an unlimited length of time. . . . This situation is quite different from wheat, corn, and other storable commodities where the futures market performs a valuable role since hedging provides risk insurance. Because of their perishability . . . we do not believe that onions and potatoes lend themselves to sound futures trading."[15] The statement of Everette B. Harris, president, Chicago Mercantile Exchange, provides sufficient commentary on this assertion: "One of the strongest arguments made against futures trading in onions has been that such trading simply is not adapted to a perishable commodity like onions . . . the reasons why such a market cannot function satisfactorily have never been explained. Actually, an onion futures market does fulfill the primary function of such a market. . . . Why kill it because of a theory?"[16]

Conclusions

The present official view of futures markets for onions and potatoes is a dim one. Hearings reports have been unfavorable to their continued existence. The C.E.A. posture, as reflected in hearings testimony, published reports, and the official position of the Department of Agriculture on H.R. 376, is one of negative neutrality. The testimony and published reports are of a negative tenor, while the official position is that the enactment of H.R. 376, prohibiting futures trading in opinions "would not significantly affect the marketing or distribution of onions."[17] To the extent that the present jeopardy of these markets rests upon ambiguity, incantation, or inconclusive statistical analysis, there is danger that they may be abolished for wrong or insufficient reasons. A constructive alternative to abolition, given the state of the evidence, would seem to be an investigation of the potential hedging use of these markets. Given the need and opportunity which exists for hedging, it seems reasonable to expect that improved understanding of hedging procedures would give rise to expanded hedging use. Without the widespread development of routine hedging, these markets are vulnerable to attack from just those quarters where hedging could provide most benefit because of the characteristically erratic price behavior of potatoes and onions during the crop movement season.

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[15] *Onion Futures Trading, op. cit.*, p. 8.
[16] *Ibid.*, p. 41.
[17] *Prohibiting Futures Trading in Onions*, H.R. Report No. 1036, 85th Congress, 1st Session, August 8, 1957, p. 4.

THE URBANIZATION OF THE OPEN COUNTRY

Kenneth C. Nobe
Cornell University

THE history of the United States is characterized by three great migrations: 1) the general move from East to West, 2) the move from rural areas to the cities, and 3) the urbanization of the open country. In some rural areas of the country the final migration is not yet underway or hardly noticeable. In other areas, especially in the industrial Northeast, this move started in the early twenties and its trend has long been evident. It is the purpose of this paper to discuss the major problems associated with the urbanization movement.

Urbanization Is Increasing

The nonfarm segment in rural areas is steadily increasing in the Northeast. To the inexperienced eye it appears only to be "shoestring" housing developments along the main highways leading out in all directions from our larger cities. Secondary roads, too, however, have been heavily settled by nonfarm people, but because of a more dispersed settlement pattern this infiltration is not nearly so obvious.

Several studies have been carried out in New York State in recent years which indicate the magnitude of this urbanization movement. Conklin found in a 1946 study that two out of three rural residences in the open country areas of Chemung and Monroe counties in New York State, within commuting distance to industrial centers, were already occupied at that time by nonfarm families, (Table 1).[1] Recent studies indicate that this proportion is now generally applicable to most of the state.

Conklin's study also showed that only a quarter of the households surveyed operated a farm business large enough to qualify under the usual family size farm concept. The author concluded that farmers do not readily liquidate a farm business in response to high industrial wages and, on the other hand, nonfarmers do not usually find the means to establish themselves as full-time farmers.[2] It was also found that the farm group is locationally stable while the nonfarm group tends to be urban, not only in employment characteristics, but also in locational instability. Many of the nonfarm group moved to their present location in the last 10 years and a substantial portion of this group made their last move from urban residences.[3]

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[1] H. E. Conklin, "The Employment of Rural People in Chemung and Monroe Counties," *Farm Economics*, Cornell University, No. 160, April, 1948, p. 4163.
[2] Ibid.
[3] Ibid.

TABLE 1. DISTRIBUTION OF OPEN-COUNTRY HOUSEHOLDS IN THE DIFFERENT LAND CLASSES BY AMOUNT OF MALE TIME DEVOTED TO FARM WORK, MONROE AND CHEMUNG COUNTIES, NEW YORK, 1946

Land Class*	Male Time Available for Farm Work	
	12 months or more** (per cent)	Less than 12 months (per cent)
III	29	71
IV	38	62
V	31	69
All Classes	33	67

* The land classes referred to in this table represent land areas made up of groups of farms among which there are major differences in the capacity to produce income. The percentage of farmers who can make a reasonably comfortable living, pay off substantial indebtedness and have money left over for retirement is higher in each successive land class.

** Full-time farms were defined as having 12 or more months of male time available for farm work.

Source: Howard E. Conklin, "Differences in Employment and Farming Among the Land Classes in Chemung and Monroe Counties," *Farm Economics*, Cornell University No. 167, March, 1949, p. 4331.

A study of rural holdings[4] was conducted in 1948 in the Township of Dryden in central New York.[5] There are no large cities in this area but there are a number of places where urban employment is available. Full-time commercial farms made up only 18 per cent of the total rural holdings and 49 per cent were classified as rural residences (Table 2). Fifty years ago this area was predominantly in agriculture; in 1948,

TABLE 2. CLASSIFICATION OF RURAL HOLDINGS,* TOWN OF DRYDEN, TOMPKINS COUNTY, NEW YORK, 1948

Group	Number of Holdings	Percentage of total
Farms (200 or more work units** on farm work)	129	18
Other Farms (hired men, partners and the like)	34	5
Small Farms (30 to 199 work units on farm work)	131	18
Rural Residences (less than 30 works units on farm work)	363	49
Other Holdings (summer homes, vacant houses and the like)	81	10
Total Rural Holdings	738	100

* A rural holding as defined is an open country house and the land used with it.

** A work unit is the average amount of work accomplished by a man in 10 hours.

Source: S. W. Warren and J. L. McGurk, "Rural Holdings in Dryden," A. E. 689, Department of Agricultural Economics, Cornell University, July, 1949.

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[4] A rural holding as defined in this study is an open country house and the land used with it.

[5] S. W. Warren and J. L. McGurk, "Rural Holdings in Dryden," A. E. 689, Department of Agricultural Economics, Cornell University, July, 1949.

rural resident holdings made up one-fifth of the total acreage in the township.[6]

The authors of this study concluded that:

"This condition represents a normal and usually desirable adjustment to changing economic conditions. The automobile and improved roads have made it possible for large numbers of people to live in the open country and work in cities and villages. Much of the agricultural land in the Northeast which formerly afforded a living for its operators is no longer profitable to farm. Each improvement in farm machinery and agricultural practices has been of greater help to farmers on good land than to those who have farms with some physical disadvantage such as rough topography or poorly drained soils. When farms with these disadvantages are sold, the buyer is often someone who wishes to live in the country but work in the city. A little farming may be done but it is usually not the main source of income. Changes in the make-up of our rural population in the Town of Dryden are occurring to a greater or lesser degree throughout the whole Northeast."[7]

Data collected in the central plain region of New York State in 1954 indicate that the farm segment of the rural population in that area has now decreased to one out of four open country residences.[8] (The central plain region occupies approximately 2,000,000 acres of the medium-to-high lime belt of New York State, lying between Buffalo and Syracuse.) Table 3 summarizes the complete enumeration of all open country dwellings in a 10 per cent random road segment sample used in this study.[9] Of the 2,532 occupied dwellings enumerated, 24 per cent were headquarters of full-time farms, 10.5 per cent were part-time farm headquarters and the remainder were rural residences.

TABLE 3. SUMMARY OF RECORDS TAKEN IN THE FARM MANAGEMENT STUDY OF THE CENTRAL PLAIN OF NEW YORK STATE, 1954

Class	Number of Records	Per cent of Total
Full-time commercial farms	633	24
Part-time farms	267	11
Rural residences	1,632	65
Total	2,532	100

Source: K. C. Nobe, "An Improved Segmented Sampling System for Farm Management Surveys," Unpublished M. S. thesis, Cornell University, 1954.

[6] Ibid.

[7] Ibid.

[8] K. C. Nobe, "An Improved Segmented Sampling System for Farm Management Surveys," Unpublished M.S. Thesis, Cornell University, September, 1954.

[9] All roads within the central plain region were divided into segments containing approximately five farms each. Nonfarm dwellings per segment were not held constant. One hundred fifty road segments were chosen at random out of a universe total of 1,470 segments.

The use of farms as places of residence by people who earn their main source of income from urban occupations has a definite influence on farm land values. Corty in a 1954 tax study in 15 New York townships noted that farms are assessed higher than rural residences.[10] The author found that farms were being assessed at 40 per cent of the owner's estimates of their probable sale value and rural residences at 25 per cent. Corty suggests that a major reason for this difference in assessment rates is that rural residences have become more numerous and have increased in value at a faster rate than farms used for farming purposes, but since assessment rolls are copied from year to year, the necessary adjustment has not yet been made.[11] Many farmers are not able to compete in the real estate market with nonfarm buyers who are buying farm properties primarily as a residence and farming only as a secondary source of income.

A recent economic land classification study in St. Lawrence county, New York has pinpointed several local areas in which the rural population is made up almost entirely of part-time farmers and rural residents,

TABLE 4. NUMBERS OF FULL-TIME COMMERCIAL FARMERS, PART-TIME AND SUBSISTENCE FARMERS, AND RURAL RESIDENTS IN EACH LAND CLASS, ST. LAWRENCE COUNTY, NEW YORK, 1955[1]

Land Class	Full-Time Commercial Farmers	Part-Time and Subsistence Farmers	Rural Residents	All Types
I	48	240	180	468
II	264	612	300	1,176
II-X	12	24	0	36
III-Y	144	96	132	372
III	780	480	336	1,596
III-X	228	132	132	492
IV-Y	168	36	12	216
IV	924	264	360	1,548
IV-X	132	60	84	276
V	70	0	36	106
VI	50	24	12	86
All farms	2,820	1,968	1,584	6,372
Per cent	44	31	25	100

[1] The land classes referred to in this table represent land areas made up of groups of farms among which there are major differences in the capacity to produce income. The percentage of farmers who can make a reasonably comfortable living, pay off substantial indebtedness and have money left over for retirement is higher in each successive land class.

Source: K. C. Nobe and K. H. Thomas, "An Appraisal of Farming Areas in St. Lawrence County, New York," A.E. 1054, Department of Agricultural Economics, Cornell University, 1957.

[10] F. L. Corty, "Comparative Levels of Assessment for Farms and Rural Residences in 15 New York Towns, 1954," A. E. 996, Department of Agricultural Economics, Cornell University, July, 1955.

[11] Ibid.

living on places which were almost all full-time farms a generation ago.[12] In this study a systematic road sample was used which involved a personal interview with every twelfth household in the open country areas of the county. It was found that 44 per cent of the families interviewed were full-time farmers (Table 4). Only four out of 10 rural families in St. Lawrence county are still engaged in full-time farming. Yet, this area has long been considered one of the most rural in New York State.

Problems Associated With Urbanization

The rapid changes that have taken place recently in open country areas pose major problems. Population components are very heterogeneous and various conflict lines are already forming. Newer residents frequently demand more public services than the older residents think necessary. Numerous disputes have arisen regarding assessment and taxing procedures. Fluctuations in industrial and commercial activity now have a great effect upon the economic status of the open country residents.

A number of questions present themselves. How should the settlement pattern be determined in areas where land no longer provides the major source of income? Should people be allowed to live any place they wish and demand that roads, schools and public utilities be provided for them? Should the tax burden in such cases be shifted from the land to the houses, inasmuch as settlement and not land use occasions the high cost of public service?

Can part-time farming provide insurance against possible future unemployment for industrially employed workers? Are agricultural margins under full-time and part-time farming coincident? Should technical assistance and service agencies for part-time farmers be supplied by agricultural extension or industry? How should the tax burden be divided between full-time farmers and nonfarmers or part-time farmers?

The problems raised by the questions above are rapidly becoming significant at a national level. Open country and the city have become interdependent. The introduction into rural areas of a significant number of nonfarming people and the use of the farm home as a place of residence for family members who work in urban centers, creates problems of accommodation and assimilation not previously encountered. Urban and rural can no longer be separated; such distinctions are rapidly being eliminated except for specific occupations. "The traditional relationships between rural and urban areas are being modified in many ways under the influence of improved transportation. No longer can a sharp line be

[12] K. C. Nobe and K. H. Thomas, "An Appraisal of Farming Areas in St. Lawrence County, New York," A. E. 1054, Department of Agricultural Economics, Cornell University, December, 1957.

drawn between the country and the city, and the problems of each be considered separately."[13]

Alternative Approaches to the Problems

The open country has become a new kind of community. We can no longer call it strictly rural; its components are too heterogeneous. Without guidance, such heterogeneity can only result in further conflict and disharmony. The basic causes of conflict are of a sociological and economic nature. There is a fundamental difference in attitudes between the farmer and the urban worker. Antagonism between these two factions can best be explained as due to a lack of mutual understanding. Several alternative approaches, some of which are only partially applicable, can be made toward eliminating this barrier to peaceful coexistence.

Basic Research and Technical Assistance

We need to know the kind of aid farm and nonfarm open country residents want and can use. We need to know the various components of this population, how they can be reached and in what form information should be supplied. Communication channels to the farmer have long been open, but they are not always applicable to the nonfarm group, nor is farmer-oriented data of much value to them.

Many nonfarm families have much to learn before they can achieve the goal of successful country living. Some, for example, wish to farm. They are often unaware of the complexities of modern-day agriculture and its increasing capital requirements, and they often go ahead without adequate preparation. Some people who thought they were making a profit on a part-time farming basis may find too late that they cannot make the grade on a full-time basis. Many others are carrying on a part-time enterprise, who, if they could see it in perspective, would abandon the project as unprofitable. Others are not aware of property developments such as reforestation, a fish pond and the like, to make country living much more enjoyable. Such families are suddenly faced with countless decisions to make with no prior experience to guide them. Properly directed extension activities can be of service to this nonfarm group.

Farmers too, have much to learn in such a new kind of community. Now outnumbered at home, they must learn to cooperate with the majority or find themselves outvoted on such basic issues as taxation, public utilities and the like.

Research and education cannot become an end within themselves but

[13] H. E. Conklin, "The Rural-Urban Economy of the Elmira-Corning Region," *Journal of Land and Public Utility Economics*, Vol. XX, No. 1, February 1944, pp. 3-19.

rather can serve as means by which both nonfarm and farm groups can meet on common ground. Adequate information is a first prerequisite to constructive collective action.

Rural Zoning as a Tool

Rural zoning is a device for the application of the police power of government to control land use. It has already been used in several areas of the country to regulate farming, grazing, forestry and the settlement pattern associated with these or other uses. The first rural zoning ordinance was passed in Wisconsin in 1933; by 1942, there were 34 counties in four states with standing rural zoning ordinances.

Rural zoning, in order to be effective and useful, depends upon: 1) active local interest, 2) the possibility for making clear-cut differentiations among alternative uses, and 3) opportunity for using simple regulations to accomplish desired goals. Rural zoning can provide a means for guiding settlement into agricultural areas and increase the efficiency with which public utilities can be supplied. It cannot, however, eliminate nonconforming land uses established prior to their natural cessation.

The feasibility of rural zoning in New York State is modified by three major factors: 1) a large nonfarm element in the open country is already established, especially in the poorer agricultural land areas, 2) a highly intermingled pattern of good and poor land, and 3) a liberal system of state aids to local governments.

Rural zoning in a modified form may be more actively attempted in the future. Local leaders in some counties, quite on their own, have indicated an interest in something that would prevent people from living in remote localities and asking for road improvements, snow removal and school bus services. Modifications of zoning may become useful tools in dealing with some urbanization problems, especially in those areas where such a movement has not yet gained momentum.

A Grass Roots Approach

It is encouarging to note that in some instances the farmers themselves are making the initial moves toward solving the mutual problems which they share with the nonfarm group. A concrete movement of this kind is underway in Broome county, New York. Here in an area of approximately 700 square miles is a concentration of over 200,000 people. Of this group about five per cent are farmers, 15 per cent are nonfarm rural residents and the remaining 80 per cent are living primarily in the Triple Cities[14] in the county's southwestern corner.

Broome county farmers are outnumbered three to one in the open

[14] Binghamton, Johnson City and Endicott, New York.

country areas. They are faced with the problem of utilizing a land resource, 63 per cent of which is not suited to full-time commercial farming.[15] Yet from this group of farmers came a bona fide request for aid in improving ways in which this 63 per cent of the land resource could be better used. They wanted to pioneer a program designed to test if, as a County Extension Service, they could make any contribution to solving the problems of open country residents in this area. This type of collective action had its beginning in Broome county in 1910 when the first Farm Bureau Extension group in the United States was organized there.

A 1946 Broome County Rural Policy Committee report included recommendations for further study of alternative uses for land in the county unsuited to full-time commercial farming. This led to research conducted by the New York State Colleges of Agriculture and of Forestry, the State Conservation Department and the Broome County Planning Board. The Land-Use Planning Committee of Broome County prepared a report based on combined research.[16] On the basis of recommendations by the Land-Use Planning Committee, a special land-use extension effort, directed primarily at nonfarm rural residents, was organized. The organization of this project was completed in 1954, and an assistant county agricultural agent was employed to do the educational work in this program.

Summary and Conclusions

The migration to the country is not just a passing fancy. It is time to recognize, and attempt to surmount, the many economic and sociological problems that accompany this trend. If there is a basis for believing that through this movement, our population will more or less stabilize itself locationally, then there is every reason for an attempt to guide and to some extent direct this movement.

The first great migration—the move from East to West—resulted in much unwise agricultural development, exploitation and waste. It created indirectly many of the improper land uses with which our nation is still struggling. The subsequent migration to the cities also went unguided and finally resulted in the numerous problems of city management with which our city fathers are faced today. Limited expansion facilities, traffic congestion and housing relocation projects are only some of the problems they face.

With these examples before us, it appears that an attempt should

[15] J. K. Pasto and H. E. Conklin, *An Economic Classification of Rural Land, Broome County, New York,* Cornell Economic Land Classification Leaflet 1, Cornell University, October, 1949.

[16] Land Use Sub-Committee of the Broome County Rural Policy Committee, "The Land of the Future," Binghamton, New York, 1952.

be made to plot this current movement of people and to instill some degree of intelligent guidance into the trend. It is not suggested that cities will find themselves decentralized and demobilized of their heavy industries or that full-time commercial farming will be abandoned. To assume, on the other hand, that neither of these segments will be further influenced by the rural urbanization process would be unrealistic.

Part-time farming will have a definite place in the rural economy of many areas. Part-time farming, no matter how much we may dislike the term, can set the pattern by which a new type of country living—semi-rural and semi-urban in nature—can be developed on a relatively large scale. In other areas which are sparsely settled and moving out of agriculture, rural zoning may be the answer to developing a wise settlement pattern.

Areas already heavily settled by nonfarm residents will have to deal squarely with existing situations. Further confusion can often be prevented by collective action. The Broome county venture represents a concrete attempt to deal with reality in such a situation. The results of this effort will bear watching. Recognition and acceptance of such a program beyond the Broome county level will necessitate a clear comprehension of the existing relationship between rural and urban economy. It will demand an expanded program of united efforts by interested parties, guided by a comprehension of the cost and utility of united concentrated effort.

Since the trend of open country urbanization can be expected to continue at an even greater pace in the future, it is important to recognize the problems brought about by this movement. The economic atmosphere of such a movement is primarily directed toward nonagricultural interests but exists within the range of agriculturally established institutions. Promoting a mutual understanding among the components of the open country appears to be the most desirable method of dealing with this phenomenon.

EDUCATIONAL REQUIREMENTS FOR EXTENSION WORKERS WITH SUGGESTIONS ON IN-SERVICE TRAINING

HAROLD C. LOVE[1]
University of Houston

The Management Era

CERTAIN trends in agriculture indicate important changes are faced by farm operators in the next decade. These changes make an inquiry into possible new educational requirements for extension workers appropriate.

The challenge to farm operators and extension workers stems from at least four important trends in agricultural production: first, increasing capital requirements per farm and per worker; second, increasing farm size with companion implications of greater mechanization, specialization and declining number of farm families and farm workers. In the years ahead successful farm operators will need management skill and operating capital in amounts that dwarf both present and historical requirements for these factors. To "know why" may be even more important than to "know how" for survival and growth of the farm firm during the next 10 years. For example, during the 10 year period 1948-1957, capital investment per worker has increased 66 per cent; farm size has increased by 5 to 17 per cent in the 10 census regions. In this same period the number of workers on farms declined 24 per cent; conversely, output per farm worker increased nearly 33 per cent. Third, rapid expansion of other segments of the nation's economy is providing increased competitive demand for the capital, labor and management skill used in agriculture.

TABLE 1. TANGIBLE ASSETS, POPULATION AND NET INCOME, FARM AS A PERCENTAGE OF TOTAL UNITED STATES 1946–1955[2]

Year	Farm assets as a percentage of total	Farm population as a percentage of total	Net income of farm population as a percentage of national
	Per Cent	*Per Cent*	*Per Cent*
1946	20.3	18.7	12.7
1950	17.1	16.5	9.4
1955	15.4	13.4	6.6

[1] This paper has benefited from the suggestions and criticisms from Paul W. Griffith and John Schnittker, Kansas State College; G. G. Gibson, John E. Hutchison and W. N. Williamson, Texas A and M College; J. W. Burch and F. E. Rogers, University of Missouri; David W. Brown, University of Tennessee, and W. Robert Parks, University of Wisconsin. Errors of fact, judgment or logic are, of course, the responsibility of the author alone.

[2] Adapted from Table 112, 1957 Agricultural Outlook Charts, United States Department of Agriculture, Washington, D. C., November 1956.

Capital investment in agriculture may double during the next 20 years in absolute terms; but the relative size of agriculture in our nation's economy is likely to decline. An example of this trend is illustrated in Table 1.

This evidence is further supported by a measurement of consumer demand in the recent "agribusiness" approach:

> Consumer purchase of agribusiness items in per cent of total U. S. expenditures of personal consumption, 1947, 44.2 per cent; 1954, 40 per cent; agribusiness labor force as a per cent of civilian labor force 1947, 41; 1954, 37.[3]

The fourth trend is the increasing number of part-time farmers. Part-time farm families are concentrated in areas adjacent to great industrial centers, but to some degree the increase can be observed in nearly every county. From the extension worker's viewpoint, building and timing an effective educational program for the part-time farm operator and his family is quite different from work with full-time commercial farm operators.

In "the management era" the premium on this skill will reach a new high by reason of the principle of increasing risk. This principle is well stated by Hicks:

> As the planned size of the firm increases, the possible losses become steadily greater; and people will become less and less willing to expose themselves to the chance of such losses.[4]

Thus as farm operators handle increasing quantities of capital and land, the possible range of outcomes in the form of large profits or large losses expands rapidly. For example, if the earning rate on a certain operation is expected to be 20 per cent, but could also result in a 20 per cent loss, then the range of possible outcomes with an investment of $10,000 would be $4,000. If $40,000 were invested, the possible range of outcome is $16,000. Hence, when interest on borrowed capital is taken into account, the size of the possible loss is always larger than that of the possible gain; and a low equity could be entirely used up as risk increases.[5]

The management problem in farming has been taken into account in many recent research studies including budgeting and linear programming investigations in Iowa, North Carolina, Illinois and other states. In these studies two or more levels of management have been applied to given resources. Superior management has been identified with higher output per unit of input. The resulting incomes show important differences

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[3] John H. Davis and Ray A. Goldberg, *A Concept of Agribusiness*, Boston: Harvard University, 1957, pp. 8-11.

[4] J. R. Hicks, *Value and Capital*, London: Oxford University Press, 1948, p. 199.

[5] Earl O. Heady, *Economics of Agricultural Production and Resource Use*, New York: Prentice Hall, 1952, pp. 539-545. Also M. Kalechi, *Essays in the Theory of Economic Fluctuations*, London: Allen & Unwin, 1939, pp. 95-106, and J. Steindl, "On Risk," *Oxford Economic Papers*, No. 7, pp. 21-45.

attributable to management when operating capital reaches or exceeds the $8,000 to $10,000 range.

What is to be the role of extension education in this prospective environment? As previously suggested by Heady and others, a shift in emphasis in land grant college work is occurring.[6] Such shifts are necessary to keep pace with agricultural adjustments caused by a growing economy. Land grant colleges are shifting more educational resources toward the relevant goal of interrelationships of agriculture with the rest of the economy. While improvement of biological and physical techniques continues to be important, it is hampered by overproduction in agriculture. The American consumer is saying through his standard of values and through the lower values he attaches to farm products and incomes that he wants less food relative to other products and that he wishes resources transferred from agriculture to other industries. While development of new techniques is necessary and must be continued, the educational emphasis needs to be shifted to aid agricultural adjustments in line with the trend in national economic growth. Such adjustments ultimately benefit those remaining in agriculture as well as those transferred. This shift toward broader objectives necessitates higher educational standards and more rigorous training for all extension workers. This paper will focus on undergraduate and inservice training for county extension personnel.

Objectives in Extension Education

Initially, the most widely held objective of extension workers was to increase farmer's net income and improve the level of living for farm people. Work toward this objective was initiated by teaching and demonstrating new and better production methods. But when followed to its conclusion, this method may not maximize income to producers of primary and secondary agricultural products. Increasing production skills without compensating adjustments have probably led to lower income for agriculture because of low income and price elasticities for most farm products. Thus, the benefits of greater and more efficient production give a temporary advantage to the innovators or first users of an improved technique but permanent benefits finally accrue to the public generally. Extension work is a public educational program supported by all taxpayers. Therefore, adjustment to the changing position of agriculture in our national economy is important for continued strength and vitality in extension work of the land grant colleges. The need for change in educational emphasis to a larger base exists even in the most rural counties.

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[6] Earl O. Heady, "Adaptation of Extension Education and Auxiliary Aids to the Basic Economic Problem of Agriculture," *Journal of Farm Economics,* Vol. 39, February, 1957.

Significantly too, legislative influence follows in some degree the human and financial resources of the various segments of our economy. Some observers now see less strength and unity in the "farm bloc" today than was apparent a decade ago. Could this observation parallel the decline of farm population and the rapid growth of the nonfarm population? Rural people are still a hugely overrepresented minority. However, farmers are apparently losing political power. In all state-wide elections (i.e. for Governor, U. S. Senator, President) the rural vote has become less and less significant. Also the number of strictly urban Congressmen has shown rapid increase in the last two decades. Over the long pull the loss in farm population must result in some decrease of farmer political power. Our declining agricultural population is normal in a nation whose industrial economy is growing. If extension workers cling to the older and specific objective of technology in their educational work, are they narrowing the market demand for their services?

In an age when conformity is a byword it is refreshing to note that each state approaches the objectives of extension work with a slightly different emphasis on what is most important and how the work should be executed. While this varied approach is sometimes disconcerting, it permits the creative academic freedom of choice so necessary in education. Anyone who deals with extension objectives and educational requirements for extension workers considers not only the world of science and research but also ventures into both the imaginative and the symbolic. This is necessarily so because as liaison personnel for the land grant colleges, extension workers must: (1) Understand the findings of research and their significance, and (2) transmit such findings to rural and urban families in attractive meaningful terms. Effective extension workers need to possess: (1) A high level of academic accomplishment and (2) the appealing qualities of showmanship. For example, advertising, radio and television industries have suggested that approximately 90 per cent of the buyer's interest is motivated by emotional appeal and less than 10 per cent by facts. In no way does this low percentage detract from the importance of facts, for in the final analysis sustained performance and repeated requests for assistance are based on the solid foundation of improved technology and new research findings.

New Methods and a New Objective

New teaching methods which extension workers might elect retain the traditional emphasis on the individual and the family as the basic units of our society but go beyond the stage of teaching technology or "know how" into the "know why" part of our changing environment. In this "know why" stage, the extension workers' knowledge must be broadened to better assist the increasing number of part-time farmers

with management decisions. The growing part-time farmer group includes those just entering agriculture, those in the transition period moving toward nonagricultural work, and many urban people who have farming interests. Greater attention to the critical decision problems of the "transition and part-time groups" will enlarge the extension workers' opportunities for service.

The new extension objective is to help those individuals, families and communities with agricultural interests to make the adjustments required by the obvious trend in national economic growth.

County extension workers need to provide farm families with information regarding opportunities in nonagricultural fields as well as information on technical agriculture. Such information would assist in the normal transfer of labor resources out of agriculture and render valuable service to other segments of the economy. Under this objective, extension will assume a co-ordinating role with many kinds of businesses closely associated with agriculture. In line with present trends and with this larger objective, county extension workers need a different type of training than was necessary under the original objective.

What is the present status of undergraduate training and competency of county extension workers? Most county extension workers have obtained college degrees in a technical field other than the social sciences or business administration. Therefore, beyond the limits of technical training, their competence in assisting families with management and decision making problems is limited to their own native ability, practical experience and observation. For many in this group, improvement will be acquired only through enlarged in-service training opportunities and practice.

For example, farm and home planning (or development) is one of the most all-inclusive tools in the county extension worker's kit. Such planning brings into focus the family's conflicting demands for the use of a limited resource (such as capital) between farm production and family living standards. Resolving these conflicts requires intimate knowledge of farm production methods and a working knowledge of the concept of opportunity costs. County workers who have had little training in economics and financial management may be unable to provide the desired assistance. While farm and home planning is a process used in some form by all farm families, its selection as an educational method by extension agents is of greatest importance for (1) those just entering farming as a business, (2) those who are shifting part or all of their resources into nonfarm activities, and (3) commercial producers who need to greatly improve their present use of resources. For both (1) and (2) groups, the planning process will aid in determination of production possibilities and income from farming; with this information they are in a position to make

rational choices between farming and other job opportunities. For the (3) group, the process includes: (a) Estimating of maximum production possibilities; and (b) locating and improving weak spots in present production, management and marketing operations.

Extension agents who use farm and home planning will find in-service training in counseling skill increasingly valuable when they are faced with conflicting objectives within the family. Counseling skill will also have wide application in work with committees and county planning groups in "program projection."

As an educational tool, farm and home planning is not widely employed by extension workers. A few counties in most states have accomplished excellent results; but, in spite of increased appropriations and administrative pressure for greater volume, the over-all pattern state by state is spotted. Perhaps the more important explanations for this spotting are: (1) Lack of background as undergraduates or lack of in-service training on this method for extension workers; (2) difficulty in finding couples where the husband and wife were both willing to participate wholeheartedly; (3) in the less well-developed agricultural areas, the acquisition of basic knowledge of production and marketing methods and consumption alternatives is the most critical management problem. The crux of farm and home planning is management skill and decision making. The knowledge and counseling techniques necessary for successful application of farm and home planning require some natural ability, but formal training plus practice and experience are also helpful.

If extension services are to maintain or improve their present competitive position as an educational organization, the undergraduate educational requirements for county personnel need progressive upward revision. In-service training in fields other than production technology will become more important.

What about the "in-take" of county extension workers? Eligibility committees and district agents who pass on applicants for county extension workers have a difficult task. The rapid annual turnover of county extension workers (about 9 to 11 per cent for county agents and 16 to 19 per cent for home economics agents annually) makes a backlog of eligible applicants desirable. One facet of their selection problem is illustrated by the following:

"In connection with its draft deferment program, the Army has had the Educational Testing Service administer a series of nation-wide scholastic aptitude tests to undergraduates, and the by-product of this has been a brutally objective index of the caliber of students in different fields and in different institutions.

"Here are the percentages of 339,000 students tested in 1951 who got a passing score of 70 or more: In first place were students majoring in engineering (68 per cent passed); next, those in the physical sciences and mathematics

(64 per cent); biological sciences (59 per cent); social sciences (57 per cent); humanities (52 per cent); general arts (48 per cent); business and commerce (42 per cent); agriculture (37 per cent); education (27 per cent). Relative rankings have not changed materially since 1951. The high scores of men majoring in the sciences would seem to indicate that while fewer people are interested in basic science these days, those who are come from the top layer."[7]

The low rank of students in agriculture intensifies the employer competition for outstanding ability, making a strong in-service training program for extension workers increasingly important.

Admittedly, a few undergraduates definitely attempt to prepare themselves for extension work, but this number is estimated to be less than 25 per cent of all applicants. This is not surprising because in 1956 only 10 land grant colleges offered an undergraduate major in extension education for agricultural students and only 14 for home economics students.[8] Many land grant colleges do not offer curricula for extension work as a major because: (1) Extension directors cannot guarantee placement of those who might enroll. (2) Apparently extension administrators prefer to follow the example of business and industry in hiring the trained technologist and retraining for the position at hand. (3) The broad general nature of extension work cuts across several vigorously maintained disciplines of learning and science. Most instructors, department heads and deans are jealously proud of their own particular field and of their students and encourage specialization. (4) Even at the beginning of the junior year many college students are uncertain regarding a chosen vocation; hence, there exists insufficient demand from students for a curriculum preparatory for extension work. Additionally, there exists no strong recruitment program for extension personnel at the high school level in most states.

If the foregoing is a fair appraisal of undergraduate training received by most county extension workers, then technology or "know how" is still receiving major emphasis. Thus, undergraduate training received by extension workers is not always in harmony with extension objectives. In the future, extension opportunities for service to individuals and families will be more frequent outside of agriculture or in part-time agriculture than in full-time commercial farm production. For each boy or girl remaining on the farm, about three farm-reared boys and girls are finding brighter employment opportunities in nonagricultural vocations. Hence, another important question may be posed: Does the county ex-

[7] William H. Whyte, *The Organization Man*, New York: Simon and Schuster, 1956, pp. 83-84. Also Dael Wolfe and Toby Oxtoby, "Distribution of Ability of Students Specializing in Different Fields," *Science*, September 26, 1952, pp. 311-314.

[8] Report of programs in extension education for professional extension workers 1956, ERST-39 (2-57) Extension Training Branch, Division of Extension Research and Training, Federal Extension Service, U.S.D.A.

tension worker have any educational responsibility for guiding the three youths who are leaving agriculture? Such a role would be new for most county workers. The caliber of such guidance could be just as important to the future of extension work as it is to those who are on the receiving end. Political implications are evident.

If the larger objective of extension is to help individuals, families and communities to make the adjustments required by the trend in national economic growth, what are the appropriate basic subjects for undergraduate and in-service training of county extension personnel? The remainder of this paper will (1) suggest important alternatives for the framework of an undergraduate curriculum for students interested in extension work, and (2) outline conditions for in-service training.

Undergraduate Curriculum for County Extension Workers

In this age of abundance it is in the public interest that the effective county extension worker must first be a good generalist rather than a specialist in one segment of technology. The good generalist is keenly aware of the nature of his environment and the changes occurring within it. Being a good generalist requires more than superficial learning. In the past, extension administrators and businessmen alike have placed their trust in technical training because it is rigorous and causes the student to stretch and extend himself to the utmost. Thus, did the learning process cause more growth than the actual technology learned. Parts of the latter become out of date in a relatively short period anyway. It is the fundamental principles acquired and the drive to obtain them that remain of permanent value to the student. In the last five years, the number of businessmen making speeches bewailing overspecialization has increased. So did the demand for specialists. Thus, businessmen have talked one way and acted another. But in extension, county workers depend on specialists in agriculture, engineering and home economics for specific in-service training and assistance to keep up-to-date with the technology needed for solution of current local problems. If the chief role of the extension specialists is agent training on an in-service basis, then undergraduate training of county extension workers in line with the broad field of their future work should be helpful.

A curriculum which gives the agricultural student rigorous training and at the same time a flexibility not found strictly in technical agriculture would include the following courses as a basic framework for the first two years: mathematics of finance, college algebra, introductory courses in general and organic chemistry, written composition and the communication skills including journalism and public speaking, introductory courses in botany, plant pathology, and entomology. In the last two years at

least one survey course and one or more intensive courses in each of the following is recommended: political science, psychology, rural sociology, statistical methods, business administration and financial management and production or consumption economics. Black has suggested a six hour course in which general economics and agricultural economics are interwoven.[9]

While exhaustive completeness is not represented in the above list, some of the reasoning supporting the selection is justified. In political science emphasis should be given to the origin and development of the democratic process because the theory of democracy is both the philosophical and operational basis of extension work. Like democracy itself, extension work is founded upon the principle that the individual has innate worth and great potential. The extension idea of helping the individual to help himself is a thoroughly democratic concept. The much revered idea of "grass roots" planning in extension's "program projection" is an adaptation of the democratic process. The expressed need for representativeness on all sorts of committees and groups with which extension works is another idea which is founded in the democratic theory and process. A knowledge of the requirements of democracy might be genuinely useful to an extension worker in helping him to resist the temptation of working too exclusively with a few influential farmers. Extension workers are also the information arm of most of the action agencies. In this function both economics and political science training are helpful.[10]

In psychology emphasis should be on human behavior and methods of influencing it. In rural sociology the study of population movement, job opportunities and requirements in nonagricultural fields, as well as how to get ideas accepted, give background for work with families who are leaving the farm and those engaged in or considering part-time farming.

Business administration and financial management courses should fill in broad gaps where many of today's extension workers find themselves inadequately trained. The basic elements of statistics or statistical methods are a prerequisite for straight thinking in present day management and for a better understanding of economics courses. Courses in economics have practical use for extension workers who assist individuals and families in deciding on their long term objectives as well as their day to day decisions.

The above curriculum is a radical departure from that taken by most

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[9] John D. Black, "Economics for Agricultural Students," *Journal of Farm Economics*, Vol. 34, August, 1952.

[10] In their original form many of the news releases offered by action agencies are heavily biased toward the agencies' objectives and notably lacking consideration of other alternatives or individual effects on a particular farm or county.

present county extension workers. It is the author's firm belief that if all new applicants for county extension positions were required to complete undergraduate work similar to that above outlined, the extension service would be better prepared to meet the challenge of a broader objective. Graduates would generally have enough alternative employment opportunities to make "guaranteed placement" no problem for extension administrators. However, the most important gain from broad and rigorous undergraduate training of county extension workers would be the greater probability of successful in-service training. Without such background, the burden placed on in-service training becomes intolerably large. It is simply too much to expect county extension workers to fill in the large gaps in their undergraduate training, keep abreast of current advances in technology, and hold a full-time position all at the same time. Full-time workers run out of hours necessary to assimilate and apply such a rigorous assignment.

The Conditions for In-Service Training

To help county extension workers keep pace with larger responsibilities in the future, district and state administrators have three courses of action. Ideally, all three should operate simultaneously.

1. Raise the academic requirements annually to obtain new agents with broader and more rigorous undergraduate training.
2. Conduct definite well-planned in-service training courses which fulfill two objectives:
   (a) To supplement undergraduate training in those areas where improvement will be most helpful, i.e., political science, economics, agricultural policy, psychology, communications, farm and home planning.
   (b) To keep county workers up to date on technological developments.
3. Encourage advanced study with financial incentives, leave privileges and scholarships; follow advanced training with recognition and advancement on a merit basis. The first course of action has already been discussed; the second and third are also important.

That course of action designed to supplement and broaden undergraduate training could well begin in the district agent's office with personnel study and a summary of the social science, psychology, financial management, business administration and communication course deficiencies as judged by a standard acceptable for today's requirements. Training courses that would correct these deficiencies for extension workers now on the job could then be planned and presented by qualified instructors either resident or extension.

In the third course of action, encouragement of advanced study, personal motivation must also be present. Such motivation must originate within the workers themselves. Education is and ever has been a very personal matter. Only if there exists a "felt need" can improvement take place. The lack of financial incentive is the most frequent reason given by extension workers for their failure to pursue advanced study. The adjustment of the work load to allow time for assimilation and application of advanced training is also important.

Under the conditions of in-service training, useful knowledge or skill is usually acquired in small quantities. Hence, a concession of time in the form of reduced work load or actual time off the job for county workers contains insurance aspects; namely, a brief certain loss of time on the job in the hope of a large future gain. Sabbatical leave privileges even for one semester for county extension workers exist in very few states. With adequate leave privileges, financial incentive in the form of scholarships and a strong possibility of advancement, the number of county extension workers taking advanced training would presumably increase.

Within the framework of the conditions outlined above, the following suggestions are offered for advanced training for all county extension personnel.

First Choice: Opportunity for advanced study toward M.S. with the aid of fellowships and assistantships in addition to sabbatical leave privileges. The curriculum would include political science, rural sociology, agricultural policy, psychology, business administration, agricultural or consumption economics and communication techniques to augment and to strengthen undergraduate training in the most effective manner.

Second Choice: Opportunity, on the basis of full pay without affecting regular annual leave conditions, to enroll in summer school at colleges where the above named courses are offered with emphasis on the special needs of extension workers.

Third Choice: A series of seminars covering in outline form those courses listed under the first choice plus assigned readings in agricultural policy and the origin of the democratic process. This series could be a part of the regular in-service training program in each state. Such seminars could be offered during district summer conferences and at other times when the work load and leave privileges of the personnel involved could be adjusted to complete the required study and outside reading. When the number of contact hours in such seminars equalled the standards of resident instruction, graduate credit should be given in the respective subjects.

Summary and Conclusions

Agriculture's most pressing and difficult problems are economic and social rather than technological. They are connected with adjustment of agriculture to a growing industrial economy.

This agricultural adjustment is characterized by four trends: (1) In-

creasing capital requirements per farm and per worker; (2) increasing farm size accompanied by specialization, mechanization and a declining farm population; (3) rapid expansion of other segments of the nation's economy provides increasing competition for agriculture's scarce capital, management skill and labor; and (4) an increasing number of part-time farmers.

Such trends suggest the new extension objective is to help those individuals, families and communities having agricultural interests to make the adjustments required by the trend in national economic growth. This means extension educational programs must include more of the "know why" of management.

1. The rapid upgrading of educational requirements for extension specialists and administrators that has occurred during the last decade should be duplicated at the county level.

2. Broader and more rigorous undergraduate training in mathematics, statistics, the social sciences, business administration and political science is needed to help county extension workers keep pace with future responsibilities.

3. Fewer than 13 per cent of the county extension workers in the United States pursue advanced study annually. Lack of financial incentive is the most frequent reason given. A second factor is that county extension workers in many states do not have sabbatical leave or other leave privileges accorded resident university personnel while obtaining advanced training.

4. Extension administrators in every state are responsible for the pattern of undergraduate requirements and in-service training programs for county workers. However, state associations of county workers also have a fundamental obligation to offer counsel and to encourage active participation in professional improvement programs.

5. Practical in-service training courses or seminars in the social sciences should be designed and presented to help county extension workers improve their skill in the "know why" area of management.

THE AGRICULTURAL EXEMPTION IN INTERSTATE TRUCKING[*]

CELIA SPERLING
Agricultural Marketing Service, USDA

STATISTICS show that, year by year, more and more products of agriculture are being hauled by truck. The truck may belong to the farmer himself, his neighbor, or a for-hire carrier. But, no matter who owns it, the truck is of great significance to the farmer, both in operating his farm and in disposing of his produce. Regulations pertaining to trucks, therefore, are of interest to the farmer as well as to economists dealing with farm problems.

In 1935 legislation was passed bringing the interstate motor carrier industry under regulation by the Interstate Commerce Commission. The Motor Carrier Act of 1935, as this law was called, became Part II of the Interstate Commerce Act.

Under the law, the Interstate Commerce Commission exercises two types of control over motor carriers: (1) Economic regulation—which includes control over who may engage in trucking, the routes or areas to be served, and the rates to be charged; (2) Safety regulation—which includes rules laid down by the Commission respecting qualifications and maximum hours of service of employees and safety of operation and equipment.

Several different types of motor carriers were specifically exempt from economic regulation—among them, haulers of agricultural commodities. It is this exemption granted agricultural haulers with which we concern ourselves here.[1] It has been the subject of controversy almost from the time of its enactment.

The "intent of Congress" at the time the law was passed has been invoked and variously interpreted to support the positions of different groups. It is our purpose here to set forth chronologically the history of the agricultural exemption in Congress and its interpretation by the Interstate Commerce Commission and the courts in leading cases so that the record may speak for itself.

It would be well to examine the current language in Part II of the

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[*] This paper does not necessarily reflect the position of the U. S. Department of Agriculture.

[1] This subject is covered in greater detail in the U. S. Department of Agriculture's Marketing Research Report No. 188, "The Agricultural Exemption in Interstate Trucking—A Legislative and Judicial History," July 1957, by the same author. In the August 1955 issue of the *Journal of Farm Economics*, an article, "Agricultural Interest in the Regulation of Truck Transportation," by Guy Black, included a critique of the agricultural exemption. MRR 188 and the present article are not intended to express a point of view, but rather to chronicle the exemption's history.

Interstate Commerce Act dealing with the agricultural exemption before tracing its evolution. It comprises three subsections as follows:

> Sec. 203
>
> . . .
>
> (b) Nothing in this part, except the provisions of section 204 relative to qualifications and maximum hours of service employees and safety of operation or standards of equipment shall be construed to include . . .
>
> (4a) motor vehicles controlled and operated by any farmer when used in the transportation of his agricultural (including horticultural) commodities and products thereof, or in the transportation of supplies to his farm; or
>
> (5) motor vehicles controlled and operated by a cooperative association as defined in the Agricultural Marketing Act, approved June 15, 1929, as amended, or by a federation of such cooperative associations, if such federation possesses no greater powers or purposes than cooperative associations so defined; or
>
> (6) motor vehicles used in carrying property consisting of ordinary livestock, fish (including shellfish), or agricultural (including horticultural) commodities (not including manufactured products thereof), if such motor vehicles are not used in carrying any other property, or passengers, for compensation;

Let us now return to its origin.

The Motor Carrier Act of 1935

At the request of the Senate Committee on Interstate Commerce, the Coordinator of Transportation drafted a bill to regulate interstate transportation by motor carriers. This was S. 1629, introduced in the Senate in 1935. This bill made no specific reference to exemption of farmers or their produce from economic regulation. They were said to be within the following exemption:

> "(b) Nothing in this part shall be construed to include . . . nor, unless and to the extent that the Commission shall from time to time find that such application is necessary to carry out the policy of Congress enunciated in section 302, shall the provisions of this bill apply to: . . .
>
> (7) the casual or occasional transportation of persons or property in interstate or foreign commerce for compensation by any person not regularly engaged in transportation by motor vehicle as his or its principal occupation or business."

Before reporting the bill out, the Senate Committee made this provision less restrictive by rewording it as follows:[2]

"(7) the casual, [or] occasional or *reciprocal* transportation of [persons] *passengers* or property in interstate or foreign commerce for compensation by any person not [regularly] engaged in transportation by motor vehicle as [his or its principal] *a regular* occupation or business."

[2] Words in brackets were deleted; those in italics were added.

Objections were raised to S. 1629 in a statement sent to Senator Wheeler (Chairman of the Senate Committee on Interstate Commerce) by several interested organizations.[3] Their objections were chiefly that motor carriers would be subject to too stringent regulation by the Interstate Commerce Commission; that highway transportation would become less flexible and more costly; and that the small truckers who were "keeping economic disaster from overtaking thousands of producers and shippers of agricultural and dairy products, livestock, and other basic commodities" would be "squeezed out."

When asked, on the floor of the Senate, whether these objections had been taken care of in the bill, Senator Wheeler said:[4]

"Mr. President, I will say to the Senator that I appreciate the fact that some of the farm organizations have filed protests against the bill. Mostly, however, they have been based on the theory that they were afraid the Interstate Commerce Commission was not going to regulate the buses and trucks as a separate institution; but we have exempted the casual or reciprocal transportation by the farmers from the operation of the bill should it become a law. In other words, any farmer who engages in casual trucking operations, say, from his farm to Des Moines, Iowa, for the purpose of carrying his products and his neighbor's products, is within the exemption."

The only specific reference to exemption from economic regulation for trucking of farm commodities or by farmers was this explanation by Senator Wheeler that Section 203(b)(7) was intended to cover it.

The Senate passed the bill in this form. In the House, a subcommittee of the Committee on Interstate and Foreign Commerce had held extensive hearings and had drafted a bill which would have imposed only safety regulations on motor carriers. The full committee rejected this and used the Senate bill as its point of departure. The House Committee, before reporting that bill out, added to it a more specific agricultural exemption:

"(8) motor vehicles used exclusively in carrying livestock or unprocessed agricultural products."

In the debate on the House floor the "intent of Congress" in incorporating the agricultural exemption in the bill was expressed and further amendments to the exemption provisions were added. Thus, Representative Gillette asked Representative Holmes, a proponent of the bill, what

[3] American Farm Bureau Federation; National Dairy Union; American National Livestock Association; National Association of Retail Druggists; The National Grange; National Cooperative Milk Producers' Federation; National Wool Growers' Association; American Assn. of Creamery Butter Manufacturers; American Ports Cotton Compress and Warehouse Association. Congressional Record, Vol. 79, part 5, p. 5733.

[4] Congressional Record, Vol. 79, part 5, p. 5735.

the object was of providing an exemption for carriers of livestock exclusively or of farm products exclusively. Mr. Holmes answered:[5]

"The object [of the exemption] was to help the farmer and keep him out of any regulation whatsoever insofar as handling unprocessed agricultural products or livestock on the farm. As an individual owner he would be exempt anyway and would not come under the provision of the bill."

As Mr. Holmes pointed out, the bill already exempted from economic regulation all private trucking where the owner of the cargo was the owner or renter of the truck in which it was hauled. Mr. Holmes explained why a carrier must haul agricultural products or livestock exclusively to qualify as an exempt carrier:[6]

"The purpose of this exemption is that a man who may take a bag of beans or a bushel of potatoes or any other unprocessed agricultural commodity and put it on his truck cannot get exemption from regulation and then go into the general trucking business in competition with his neighbor who has a legitimate permit to operate as a contract carrier."

Representative Jones, Chairman of the House Agriculture Committee, offered an amendment to exempt motor vehicles controlled and operated by cooperative associations. He explained that cooperatives haul for nonmembers, not to make money, but to reduce the marketing expenses of their members. This hauling, he said, also serves farmers temporarily in the community and tenants who might otherwise be left without transportation facilities.[7]

Several members raised questions about the interpretation of "unprocessed agricultural products." As a result, Representative Pettengill, speaking for the Committee, proposed an amendment substituting for "unprocessed agricultural products" the words "agricultural commodities (not including manufactured products thereof)."

The following discussion, which has been referred to many times since, gives an indication of the scope intended for the commodity exemption by the Congress:[8]

MR. PETTENGILL. Mr. Chairman, we have heard a good deal of discussion this afternoon as to what is a processed agricultural product, whether that would include pasteurized milk or ginned cotton. It was not the intent of the committee that it should include those products. Therefore, to meet the views of many members we thought we would strike out the word "unprocessed" and make it apply only to manufactured products.

[5] Congressional Record, Vol 79, part 11, p. 12212.
[6] Ibid., p. 12212.
[7] Ibid., p. 12218.
[8] Ibid., p. 12220.

MR. WHITTINGTON. In other words, under the amendment to the committee amendment, cotton in bales and cottonseed transported from the ginneries to the market or to a public warehouse would be exempt, whereas they might not be exempt if the language remained, because ginning is sometimes synonymous with processing.

MR. PETTENGILL. That is correct.

Representative Bland offered an amendment to broaden the exemption to cover "fish, including shellfish." It was accepted without discussion.

Representative Whittington proposed and the House approved an amendment[9] ". . . to strike out that language that would give the Interstate Commerce Commission power to nullify the exception which both the Committee of the Whole and this Committee here have approved in this bill. If that language . . . remains, then it will be possible for the Interstate Commerce Commission to nullify the exception that grants a privilege to the farmer, the occasional operator of a truck, to haul his produce to market. That is the purpose of the amendment; . . ."

The Motor Carrier Act of 1935 (P.L. 255) became law on August 9, 1935. It contained provisions for the exemption of agricultural haulers in the following form:

> Sec. 203
>
> . . .
>
> (b) Nothing in this part, except the provisions of section 204 relative to qualifications and maximum hours of service of employees and safety of operation or standards of equipment shall be construed to include . . .
>
> (4a) motor vehicles controlled and operated by any farmer, and used in the transportation of his agricultural commodities and products thereof, or in the transportation of supplies to his farm; or
>
> (4b) motor vehicles controlled and operated by a cooperative association as defined in the Agricultural Marketing Act, approved June 15, 1929, as amended; or . . .
>
> (6) motor vehicles used exclusively in carrying livestock, fish (including shellfish), or agricultural commodities (not including manufactured products thereof);

The clauses in the Motor Carrier Act dealing with the exemption of the farmer himself and of farm cooperatives have remained pretty much as originally enacted. Section 203(b)(6), on the other hand, has been the subject of much litigation and of repeated attempts to amend it.

Amendments and Interpretations from 1935 through 1955

Public Law 777, enacted June 29, 1938, amended Section 203(b)(6) to read as follows:[10]

"(6) motor vehicles used [exclusively] in carrying *property consisting of* livestock, fish (including shellfish), or agricultural commodities (not including

[9] Ibid., p. 12225.
[10] See footnote 2.

manufactured products thereof), *if such motor vehicles are not used in carrying any other property, or passengers, for compensation;"*

This modification was introduced after the Interstate Commerce Commission had interpreted the clause to mean that, if a vehicle was used *at any time* to transport anything other than "agricultural commodities (not including manufactured products thereof)," it forfeited forever the privilege of operating under the exemption. This interpretation has come to be known as the "poisoned vehicle" doctrine. To provide relief from such a rigid interpretation, the above amendment made the commodity being carried in the vehicle, rather than the vehicle itself, the controlling factor in the application of the exemption.

On May 27, 1939, the Legislative Committee of the Interstate Commerce Commission recommended to the Senate Committee on Interstate Commerce that Section 203(b)(6) be amended to limit the exemption to movements "from the point of production to the point of primary market, processing, manufacture or transshipment." This limitation to the first movement off the farm would have imposed a severe restriction on the application of the exemption. The Senate Committee took no action on this recommendation.

On January 29, 1940, the ICC's Legislative Committee again recommended to the Senate Committee that the application of Section 203(b)(6) be limited to the first movement off the farm or (for fish) off the wharf. The suggested language, although not quite the same as in the previous year, was equally restrictive. Again, the Senate Committee took no action.

The Transportation Act of 1940 (Public Law 785) made some revision in each of the clauses dealing with the agricultural exemption. It changed Section 203(b)(4a) to read: "Motor vehicles controlled and operated by any farmer *when* used in the transportation . . .," substituting "when" for "and." Section 203(b)(4b) was renumbered and became Section 203(b)(5) worded as follows:[11]

"(5) motor vehicles controlled and operated by a cooperative association as defined in the Agricultural Marketing Act, approved June 15, 1929, as amended, *or by a federation of such cooperative associations, if such federation possesses no greater powers or purposes than cooperative associations so defined;"*

Section 203(b)(6) was modied to include "*ordinary* livestock" rather than "livestock."

Shortly after the Transportation Act of 1940 went into effect, the ICC, on November 7, 1940, announced its decision in the first Monark Egg

[11] See footnote 2.

case.[12] This decision was based on an application of the "poisoned vehicle" doctrine.

The Monark Egg Corporation transported eggs for its own account as a private carrier. As a return haul it carried commodities for others for compensation. Since it carried what it considered to be exempt commodities in its for-hire hauls, Monark claimed that it did not require either a certificate of convenience and necessity or a permit for any of its operations.[13] However, it applied for a permit merely for clarification. The commodities involved were chiefly fish and oysters but also included shelled pecans, shelled walnuts, and dressed poultry, picked but not drawn.

The Commission denied the application and ruled that if any of the commodities carried by Monark for compensation did not fall within the provisions of Section 203(b)(6), then all of the operations of every vehicle used in hauling such nonexempt commodities for compensation were subject to the certificate or permit provisions of the act. It ruled further that dressed poultry and shelled nuts were not exempt commodities because "dressed poultry does not come within the term livestock" and shelled nuts "are products resulting from processing beyond that forming a part of the harvesting or ordinarily customary in the preparing of the commodities for market by the producer."

In line with his reasoning, the Commission found that none of Monark's motor vehicles used in the transportation of property for compensation was exempt from the act's requirement of a certificate or permit.

On March 20, 1942, the Senate Committee on Interstate Commerce reported out S. 975, a bill introduced by Senator Gurney to include the transportation of horticultural products along with agricultural products in subsections (4a) and (6). It was never brought to a vote.

In May 1943, Senator Lodge introduced S. 1148, a bill which would amend Section 203(b)(6) to limit the exemption to carriage by the producers of the property or by private carriers if they never carried any freight for compensation. By excluding for-hire carriage, this amendment would have nullified the subsection completely. The bill died in committee.

After the ICC had ruled in the Monark Egg case, it received requests for reconsideration. The case was opened for rehearing and the Commission rendered its decision in the second Monark Egg case on October 2,

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[12] No. MC-89207, Monark Egg Corporation Contract Carrier Application, 26 M.C.C. 615.

[13] The Interstate Commerce Act, in Sections 206 and 209, requires that *common* carriers of property in interstate commerce must have a "certificate of convenience and necessity" from the Commission to operate; *contract* carriers must obtain from the Commission a "permit" to operate.

1944.[14] It denied Monark's application again but for a different reason. The first decision had been based on the "poisoned vehicle" doctrine; this time the "channels of commerce" principle was invoked. The Commission said, in part:

"The legislative history indicates that the benefits of the exemption were intended for the farmer by affording relief in the transportation of his products to the point where they first enter the ordinary channels of commerce."

Since both shelled nuts and dressed poultry were considered to have entered the ordinary channels of commerce, the hauling of these commodities was held to fall outside the scope of the exemption. On the subject of fish, the majority of the Commission stated that "only fish and shellfish dead or alive, as taken from the water, are within the purview of this exemption." Since evidence had shown that much of the fish shipped has been beheaded and gutted on the fishing boat before landing at the pier, this interpretation would considerably narrow the application of Section 203(b)(6) with regard to fish.

Commissioner Lee dissented from the majority opinion. With reference to fish, he said:

"It should be noted that Congress did not limit the meaning of the word 'fish' as was done in the case of 'agricultural commodities.' On the contrary, by the parenthetical phrase '(including shellfish)' Congress indicated that all 'fish' falls within the exemption."

As for poultry and nuts, Commissioner Lee applied the "substantial identity" test, saying:

"The killing, picking, and drawing of poultry and the shelling of the nuts do not result in their transformation into new or different articles. They still remain, and continue to be known as, poultry and nuts. They continue to be adapted for exactly the same uses and purposes. In my opinion, they are still agricultural commodities and not manufactured products of such commodities. This opinion is in accord with the construction placed on the term 'manufactured products' by the United States Supreme Court."[15]

The ICC applied the "channels of commerce" principle again in the Harwood case,[16] decided in 1947. In this instance cut-up salads and washed spinach were found to be outside the scope of the exemption. Commissioner Lee dissented from this decision too.

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[14] No. MC-89207, Monark Egg Corporation Contract Carrier Application, 44 M.C.C. 15.

[15] Commissioner Lee referred to the definition of "manufactured products" in Hartranft v. Weigmann (121 U.S. 609) and Anheuser-Busch Assn. v. United States (207 U.S. 556)—cases which arose under the tariff laws.

[16] No. MC-107669, Norman E. Harwood Contract Carrier Application, 47 M.C.C. 597.

The Commission reverted to the "poisoned vehicle doctrine" in the Dunn case.[17] This case was carried to the U. S. Circuit Court of Appeals, which handed down its decision on February 5, 1948.

Dunn used his vehicles to carry nonagricultural commodities in intrastate commerce and used the same vehicles occasionally (19 trips distributed among five vehicles over a period of a year) to carry baled cotton in interstate commerce. The Commission contended that "it makes no difference whether the 'other property' is carried 'at the same time,' *at some other time*, or whether it is moving in intrastate or in interstate commerce." The district court overruled the Commission's position and held that the exemption did apply to the hauling of baled cotton because the vehicles were "not *at the same time* used in carrying any other property for compensation."

The U. S. Circuit Court of Appeals upheld the district court and said: "Its [the Commission's] contention is that a single use at any time of a truck for the carriage of 'other property' for hire excludes the truck from the exemption, we suppose so long as its ownership is unchanged. This is so unreasonable and so crippling both to intrastate carriage for hire and to the free interstate carriage of the privileged commodities, and even contrary to the general policy of the legislation, that it cannot be the true legislative intent."

Shortly after the "poisoned vehicle" doctrine was overruled by the courts the phrase in Section 203(b)(6) dealing with "fish (including shellfish)" was brought to court for interpretation in the Love case.[18] The Interstate Commerce Commission sued in Federal District Court to enjoin Love from operating as a common carrier in interstate commerce without a certificate from the Commission. The cargo which Love claimed to be exempt included fresh and frozen headless shrimp. Evidence showed that shrimp are shipped only in a headless state, most of them being beheaded on the fishing boat before being brought in to shore.

By applying the "substantial identity" test, the court found the transportation of fresh and frozen headless shrimp to be within the scope of the exemption. The court said further:

"If the Commission's holdings were followed, they would nullify the exemption accorded motor vehicles transporting shrimp, by virtue of the shrimp being beheaded, because no shrimp are transported to market which are not beheaded. In this way, and through such an interpretation, the Commission has given no effect whatever to the exemption provided in the statute for fish, insofar as it affects the transportation of shrimp."

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[17] Interstate Commerce Commission v. Dunn (5 Cir. 1948), 166F 2d 116.

[18] Interstate Commerce Commission v. Love (E. D. La. 1948) 77F. Supp. 63., (5 Cir. 1949) 172 F. 2d 224.

On appeal, the U. S. Circuit Court of Appeals upheld the lower court on February 11, 1949.

After the decision in the Love case, the ICC reopened the Monark Egg case[19] to determine the effect of this decision on the transportation of fish by Monark. The Commission broadened its interpretation of the term "fish (including shellfish" to include "frozen, quick frozen, and unfrozen fish in the various forms in which it is shipped, such as live fish, fish in the round, beheaded and gutted fish, filleted fish, beheaded shrimp, and oysters, clams, crabs and lobsters, with or without shells, including crab meat and lobster meat, but excluding fish in hermetically sealed containers or fish which has been otherwise treated for preserving such as smoked, salted, pickled, spiced, corned or kippered."

Commissioners Rogers and Patterson dissented from the majority opinion and continued to adhere to the "channels of commerce" principle.

The Commission handed down its decision in the third Monark case on September 23, 1949, and on March 30, 1950, Representative Kilday introduced H. R. 7547 to amend Section 203(b)(6) as follows:[20]

> "(6) motor vehicles used in carrying property consisting of ordinary livestock, live poultry [or] *and other* agricultural commodities (not including *the products of slaughter, nor preserved, frozen, or* manufactured products [thereof]), *and* fish (including shellfish *but not including preserved, frozen, processed, or manufactured products*), if such motor vehicles are not used in carrying any other property, or passengers, for compensation."

This bill would have narrowed the interpretation of Section 203(b)(6) considerably, but it was never reported out by the House Committee on Interstate and Foreign Commerce.

The Weldon case[21] was the next major case calling for an interpretation of Section 203(b)(6). Weldon had been transporting raw, shelled peanuts in interstate commerce, and the ICC sought an injunction claiming that he did not hold a valid certificate for this operation. Weldon claimed that the commodity was within the scope of the agricultural exemption. The Federal District Court granted the injunction, stating that raw, shelled peanuts are a manufactured product, and therefore subject to regulation. Weldon appealed to the U. S. Court of Appeals but, in so doing, he abandoned his contention that the transportation of shelled peanuts was exempt. Instead, he claimed that his operation was covered by a valid certificate. The Court of Appeals, therefore, did not have before it the question of the interpretation of Section 203(b)(6). It did, however, sus-

[19] No. MC-89207, Monark Egg Corporation Contract Carrier Application, 49 M.C.C. 693.

[20] See footnote 2.

[21] Interstate Commerce Commission v. Weldon (D. C. Tenn. 1950) 90 F. Supp. 873; Weldon v. I.C.C. (6 Cir. 1951) 188 F. 2d 367; 342 U.S. 827.

tain the injunction granted by the lower court. The U. S. Supreme Court refused Weldon's request for a review of the case.

At about the same time, the ICC brought suit against the Service Trucking Company[22] for hauling shell eggs without a certificate as a return cargo after hauling dressed poultry. This was another attempt to apply the "poisoned vehicle" doctrine, but the courts rejected it and found in favor of the carrier. Both the district court and the Circuit Court of Appeals cited the precedent established in the Dunn case and quoted from the decision in that case that "the interpretation sought by the appellant '. . . is so unreasonable and so crippling . . . to the free interstate carriage of the privileged commodities, and even contrary to the general policy of the legislation, that it cannot be the true legislative intent.'"

Because of the questions raised by the interpretations of the courts, the ICC, on its own motion, instituted an investigation on July 9, 1948, into the meaning of the term "agricultural commodities (not including manufactured products thereof)" as used in Section 203(b)(6). This has come to be known as the Determinations case[23] and marks a milestone in the history of the exemption. Upon petition of the U. S. Department of Agriculture, the Commission reopened the Harwood case for hearing on a consolidated record with the investigation proceeding. The report in both cases was handed down on April 13, 1951.

Evidence was submitted by the U. S. Department of Agriculture, many states, agricultural marketing associations, farmer organizations, shippers, growers, carriers, and others. The Department of Agriculture took position that the exemption "should be construed by the Commission to exempt the transportation of all agricultural commodities on which some labor has been performed or mechanical skill applied in order to place such commodities on the consumer markets so long as such treatment does not clearly and by scientific analysis constitute manufacturing." In that connection it offered expert testimony of natural scientists on which forms of processing change a commodity from an unmanufactured state to a manufactured one.

The Commission concluded that "the term 'agricultural commodities' as used in section 203(b)(6) embraces all products raised or produced on farms by tillage and cultivation of the soil, (such as vegetables, fruits and nuts); forest products; live poultry and bees; and commodities produced by ordinary livestock, live poultry and bees (such as milk, wool, eggs and honey)."

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[22] Interstate Commerce Commission v. Service Trucking Co., Inc. (E.D. Pa. 1950) 91 F. Supp. 533; (3 Cir. 1951) 186 F. 2d 400.

[23] No. MC-C-968, Determination of Exempted Agricultural Commodities, 52 M.C.C. 511.

It concluded further that "the term '(not including manufactured products thereof)' means agricultural commodities in their natural state and those which, as a result of treating or processing, have not acquired new forms, qualities, properties or combinations."

Most of the opponents of the above interpretation contended that the "channels of commerce" principle should control the application of the exemption. The Commission now specifically rejected this and referred to the intent of Congress in enacting the exemption provisions to support its position. It referred to the discussion during the House debate on S. 1629 (in 1935) in which it was clearly shown that the House intended ginned cotton, cottonseed, and pasteurized milk to be included within the scope of the exemption. Pasteurization and bottling of milk for sale to consumers is customarily done at dairies in the larger cities, and most cottonseed is sold by farmers to the ginners.

The Commission said: "In the light of these practices and the clear intent of Congress that pasteurized milk was to be included in the partial exemption, irrespective of the fact that the milk was processed after entering the ordinary channels of commerce, or that the cottonseed was sold to the ginner, it is difficult to conclude that Congress intended that other agricultural commodities, processed (but not manufactured) or packaged for consumer use, regardless of ownership, should be treated differently. Moreover, to hold that the place at which the commodities are predominantly processed or packaged is controlling of the applicability of the partial exemption would, in many instances, prevent the movement by exempt vehicle of items processed or packaged by farmers themselves, a result obviously not intended by Congress."

The findings of the Commission included a list of those agricultural commodities which had been determined, on the basis of the evidence presented, to be unmanufactured. This was not intended as an exhaustive list, but rather as a guide to be used in judging the eligibility of other commodities for exempt status.

The earlier decision in the Harwood case was reversed, and the Commission ordered that, to the extent that findings in previous cases of the exempt status of specific commodities differed from the findings in this case, the previous decisions be overruled.

Several organizations representing motor carriers subject to ICC economic regulation had petitioned the ICC to reopen the Monark Egg case[24] for further consideration and oral argument. (In general, regulated motor carriers disapprove of the fact that the agricultural exemption permits new competitors to enter the transportation business without governmental permission.) The petitioners argued that the Commission had

[24] No. MC-89207, Monark Egg Corporation Carrier Application, 52 M.C.C. 576.

erred in extending the precedent in the Love case (the exemption of headless shrimp) to other species of fish and shellfish. Instead, they sought adherence to the "channels of commerce" principle. The Commission handed down its fourth Monark decision concurrently with that in the Determinations case. The majority rejected the argument of the petitioners. Commissioners Rogers and Cross dissented, taking a position in favor of the "channels of commerce" theory.

In 1952 another effort was made to amend the agricultural exemption provisions. Senator Johnson of Colorado (Chairman of the Senate Committee on Interstate and Foreign Commerce) introduced S. 2357, by request. In its original form (introduced January 10, 1952) this bill would have eliminated trip leasing[25] of farmers' vehicles by an amendment to Section 203(b)(4a) and would also have limited, by definition, the products of agriculture which could be carried under the exemption. Section 203(b)(6) would have been rewritten completely to eliminate commercial transportation of agricultural commodities from the benefit of the exemption—in effect, nullifying the subsection entirely.

In March, Senator Johnson offered for committee consideration another version of the bill, recommended by the Legislative Committee of the Interstate Commerce Commission. This would have limited the exemption granted to farmers in Section 203(b)(4a) to the first movement off the farm and would have limited Section 203(b)(6) only to the movement of fish from the wharf to market or to the first point of processing, or to storage.

In April, Senator Johnson offered a third version of the bill (also recommended by the Legislative Committee) which would have left subsection (4a) unaltered and would have limited subsection (6) to "the transportation of ordinary livestock (including poultry), whole fresh fish (including shellfish), or agricultural commodities (not including manufactured products thereof), in the first movement from the point of production to the point of sale by the producer, or to the point of manufacture or transshipment."

This bill represented another effort on the part of the Interstate Commerce Commission to have the scope of the exemption limited through legislation. This effort, like those in 1939 and in 1940, proved unsuccessful.

S. 2357, as finally reported out of committee, merely inserted for clari-

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[25] This term is used to designate the practice of leasing a motor vehicle for a single trip, usually a return haul, by a carrier (private or for-hire), and generally to a trucking firm subject to economic regulation by the Interstate Commerce Commission. Since exempt haulers are not allowed to transport manufactured commodities, this practice permits the avoidance of the economic waste of an empty return movement, and thereby permits cuts in the cost of delivering agricultural commodities to market.

fication in subsections (4a) and (6) the words "(including horticultural)" after "agricultural." This language became law (P.L. 472) on July 9, 1952.

At the same time that this bill was under consideration, another case[26] testing the scope of the exemption was brought into Federal District Court in Kentucky by the ICC. The Commission sought to enjoin the Yeary Transfer Company from carrying redried leaf tobacco in interstate commerce without a certificate. It was shown that the redrying process merely hastened the drying which would take place naturally in a longer period of time—that it was not a manufacturing process. The court held that redried leaf tobacco is an agricultural commodity and dismissed the action. The U. S. Court of Appeals upheld the lower court.

Another suit was before a Federal District Court in Florida at the same time that the Yeary case was pending. This case[27] involved the Florida Gladiolus Growers Association and was directly affected by the enactment of Public Law 472. The Association was engaged in raising, shipping, and transporting cut gladiolus and gladiolus bulbs. It brought suit to enjoin the ICC from enforcing its order in the Determinations case which held nursery stock, flowers, and bulbs were not agricultural commodities within the meaning of Section 203(b)(6).

The 1952 amendment—"(including horticultural)"—was passed while this case was in litigation. The court granted the injunction, saying that there was no question that cut flowers and bulbs are "horticultural commodities."

In 1953 the Kroblin case[28] was decided by a Federal District Court in Iowa. The question at issue was whether the interstate hauling of New York dressed and eviscerated poultry falls within the scope of Section 203(b)(6)—whether fresh dressed poultry is an agricultural commodity or a manufactured product.

The court found the commodity in question to be eligible for the exemption and supported its position by reference to the intent of Congress. It accepted Kroblin's contention that Congress, by changing the language from "unprocessed agricultural commodities" to "agricultural commodities (not including manufactured products thereof)," intended that "farm commodities could be processed without losing their status as an exempt commodity and that it was only when such commodities had achieved the status of manufactured articles that they lost their exempt status."

[26] Interstate Commerce Commission v. Yeary Transfer Co., Inc. (E.D. Ky. 1952) 104 F. Supp. 245; (6 Cir. 1953) 202 F. 2d 151.

[27] Florida Gladiolus Growers Assn. et al. v. United States et al. (S.D. Fla. 1952) 106 F. Supp. 525.

[28] Interstate Commerce Commission v. Kroblin (N.D. Iowa 1953) 113 F. Supp. 599; (8 Cir. 1954) 212 F. 2d 555; 348 U.S. 836.

The judge stated his decision as follows: "It is the holding of the Court that New York dressed poultry or eviscerated poultry do not constitute 'manufactured' products within the intent and meaning of Section 203 (b)(6). It is the feeling of the Court that an opposite holding would in reality constitute an attempt to accomplish by means of judicial construction that which Congress has steadfastly refused to allow to be accomplished by legislation."

The U. S. Circuit Court of Appeals sustained the lower court. On October 14, 1954, by a tie vote, the U. S. Supreme Court denied 'certiorari,' refusing the Commission's petition that it review the case.

In 1954 and again in 1955, bills were introduced in the Senate to restrict the exemption with reference to a single commodity, tobacco. Both bills were intended to limit the exempt transportation of tobacco to the first movement off the farm. Neither was reported out of committee.

Another bill, this time to broaden the exemption to include butter, was allowed to die in the House Committee on Interstate and Foreign Commerce in the 1956 session.

In its 69th Annual Report to Congress (November 1, 1955), the ICC recommended that Section 203(b)(6) be amended (1) to limit the exemption of motor vehicles transporting agricultural commodities, fish, and livestock to transportation from point of production to primary market, and (2) to limit the exemption specifically to the transportation of commodities produced in the United States. On this Commission recommendation as on similar ones made by its Legislative Committee in 1939 and 1940 to limit the exemption to the first movement of agricultural commodities, Congress took no action.

Recent Decisions

We come now to the series of cases which may be said to be directly responsible for the lively controversy currently being carried on with reference to the exemption and for the bills introduced in Congress in 1957 designed to limit its scope. They are the Frozen Food Express case and the Home Transfer and Storage case.

First, let us consider the Frozen Food Express case.[29] This case comprises two separate and distinct actions. One (Civil Action 8396) arose from a complaint, filed by three motor carriers before the Interstate Commerce Commission, charging that the Frozen Food Express Company was transporting fresh and frozen dressed poultry, fresh and frozen meats, and meat products between points in interstate commerce not

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[29] Frozen Food Express v. United States of America and Interstate Commerce Commission (S.D. Texas 1955) 128 F. Supp. 374; 351 U. S. 40, 49; (S.D. Texas 1956) 148 F. Supp. 399; 355 U. S. 6.

authorized by its certificate of convenience and necessity. Frozen Food Express admitted that this was so, but claimed that all these items were included in the agricultural exemption. The Commission ruled all these products to be outside the scope of the exemption and ordered the carrier to cease this operation. The company requested the Federal District Court to review the order except for meat products. This case was heard and decided by the three-judge court concurrently with Civil Action 8285 (January 26, 1955).

Citing the Kroblin decision as precedent, the court found fresh and frozen dressed poultry to be "agricultural commodities" within the meaning of Section 203(b)(6). Fresh and frozen meats were deemed to be neither "ordinary livestock" nor "agricultural commodities" and therefore outside the exemption.

Frozen Food Express accepted the decision against it with regard to fresh and frozen meats, and meat products. The decision on fresh and frozen poultry was appealed by the ICC, East Texas Motor Freight Lines, and Akron, Canton and Youngstown Railroad. The U. S. Supreme Court upheld the lower court (April 23, 1956) on the strength of the "substantial identity" test. The Court delivered itself of the now immortal words: "A chicken that has been killed and dressed is still a chicken." It said: "The removal of its [the chicken's] feathers and entrails has made it ready for market. But we cannot conclude that this processing which merely makes the chicken marketable turns it into a 'manufactured' commodity."

The Court concluded that killing, dressing and freezing a chicken is no more drastic a change than ginning of cotton or processing milk by pasteurizing, homogenizing, adding vitamin concentrates, standardizing, and bottling. It said further: "At some point processing and manufacture will merge. But where the commodity retains a continuing substantial identity through the processing stage we cannot say that it has been 'manufactured' within the meaning of Section 203(b)(6)."

It described the purpose of the exemption as follows: "The exemption of motor vehicles carrying 'agricultural (including horticultural) commodities (not including manufactured products thereof)' was designed to preserve for the farmers the advantage of low-cost motor transportation. . . . The victory in the Congress for the exemption was recognition that the price which the farmer obtains for his products is greatly affected by the cost of transporting them to the consuming market in their raw state or after they have become marketable by incidental processing."

In the other (Civil Action 8285), Frozen Food Express Company, a certificated carrier, brought action in Federal District Court in Texas to enjoin the ICC and the United States from enforcing or recognizing the validity of the Commission's report in the Determinations case. The company wanted to haul agricultural commodities to and from all points within

the United States, irrespective of the limitations imposed by its own certificate. The firm claimed that the report in the Determinations case, by excluding certain commodities from the exemption, deprived it of the right to do so.

The three-judge Federal District Court decided (in January 1955) that the report was not subject to judical review because the proceeding before the Commission had not been an adversary one and, therefore, the report did not have the force of an order. The company appealed this decision to the U. S. Supreme Court, which reversed the lower court and (in April 1956) remanded the case to the Federal District Court with instructions that it review the report in the Determinations case.

Guided by the Supreme Court's decision of April 1956 as to dressed poultry, the district court then reviewed the Commission's findings in the Determinations case and declared (December 31, 1956) a large number of agricultural commodities to be exempt that had undergone processing but had retained their original identity. It declared other agricultural commodities to be nonexempt because they had acquired "a new identity, with new properties."

The Interstate Commerce Commission and other interested parties appealed the decision with respect to dried egg powder, dried egg yolks, powdered milk, buttermilk, and quick frozen fruits and vegetables. The Commission said that its limited appeal meant that it had accepted the Court's decision on the other commodities involved. The Supreme Court, on October 14, 1957, affirmed the decision of the lower court on the commodities in question.

The second of these recent cases involves the Home Transfer and Storage Company.[30] This motor carrier hauled frozen fruits and vegetables interstate without authorization from the ICC. The Commission ordered him to cease this operation, but the carrier contended he needed no operating authority because these products are exempt.

Home Transfer asked a three-judge Federal District Court in the State of Washington to set aside the Commission's order. The court pointed out that this was the first time a court had been asked to determine the specific question: "Are frozen fruits and frozen vegetables agricultural commodities or manufactured products thereof?"

The decision, rendered on May 7, 1956, was based on the test of "continuing substantial identity," citing as precedent the Supreme Court decision in the Frozen Food Express case, rendered two weeks earlier. It said: "Although the Supreme Court decision of April 23, 1956 . . . did not involve frozen fruits and vegetables, as does this one, we think, in the

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[30] Home Transfer and Storage Co. v. United States of America and Interstate Commerce Commission (W.D. Washington 1956) 141 F. Supp. 599; 352 U.S. 884.

absence of other Supreme Court action controlling ours, that the quoted statements of that Court in that case inescapably apply and guide us to similar conclusions on the facts of this case to our decision against the validity of the Commission's order under attack here."

Describing the quick-freezing process for fruits and vegetables, the court commented: "In other respects than those mentioned, these processed fruits and vegetables remain essentially in the same shape and form as nonprocessed fruits and vegetables."

As a result of this finding the court concluded: "Such results of the processing here make applicable to the facts of this case the above quoted Supreme Court statement in its April 23, 1956, decision that:

" 'But where the commodity retains a continuing substantial identity through the processing state we cannot say that it has been "manufactured" within the meaning of Section 203(b)(6).' "

On appeal by the Commission, the U. S. Supreme Court affirmed the decision of the district court (November 5, 1956).

Besides these two significant cases, the question of the exemption of raw shelled nuts has been raised again. Earlier, the Monark, Weldon, and Determinations cases had dealt with this commodity and found it to be outside the scope of the exemption. This time the Consolidated Truck Service, Inc.[31] sued before a three-judge Federal District Court in New Jersey to set aside and annul the ICC's finding in the Determinations case that raw shelled nuts were manufactured products. The Commission, in this case, agreed with the "substantial identity" test which the Supreme Court had set forth. However, it maintained that raw shelled nuts did not retain a continuing substantial identity with raw unshelled nuts.

The court disagreed with the Commission and added: "The Supreme Court in its East Texas Lines [Frozen Food Express case] decision emphasized the fact that the farmer won a victory in Congress by enactment of Section 203(b)(6) . . . and that the enactment was recognition of the fact that the price obtained by the farmer for his product is greatly affected by the cost of transporting it to market whether in its raw state or after it has become marketable by incidental processing. True, the raw shelled nut can be shipped at a lower cost but that has nothing to do with its continuing substantial identity to a raw unshelled nut.

"The shelling process by which the shell is removed from a nut adds nothing to the nut. It does not change the substantial identity of the nut. No new or different product emerges. After shelling, the nut is still a nut. The shelling of raw nuts does not convert these agricultural commodities into manufactured products thereof."

[31] Consolidated Truck Service, Inc. v. United States of America and Interstate Commerce Commission (D.N.J. 1956) 144 F. Supp. 814.

In line with this reasoning, the court declared the decision in the Determinations case, insofar as it found raw shelled nuts not to be agricultural commodities within the meaning of Section 203(b)(6), to be invalid and ordered that it be set aside. This was on September 28, 1956. On December 31, 1956, the Federal District Court in Houston, sitting on the Frozen Food Express case, took the same position on raw shelled peanuts when it reviewed the report in the Determinations case.

Legislation Now Pending Before Congress

In its 70th Annual Report (November 1, 1956), as in the previous one, the ICC recommended that the agricultural exemption granted by Section 203(b)(6) be restricted to apply only so long as the commodities remain within the actual possession and control of the producer. In March 1957, the chairman of the Senate and House Committees on Interstate and Foreign Commerce introduced identical bills[32] to effectuate this proposal. These bills would also remove dressed poultry (by the specific inclusion of live poultry) and frozen foods (by specific exclusion). Section 203(b)(6) would be revised to read as follows:[33]

"(6) motor vehicles used in carrying property consisting of ordinary livestock, live poultry, fish (including shellfish), or agricultural (including horticultural) commodities (not including manufactured products thereof *or frozen foods*) *from the point of production to a point where such commodities first pass out of the actual possession and control of the producer,* if such motor vehicles are not at the same time used in carrying any other property, or passengers, for compensation. *For the purpose of this paragraph, the point of production for fish shall be deemed to be the wharf or other landing place at which the fishermen debarks his catch, and the point of production for agricultural commodities shall be the point at which grown, raised or produced, or the point at which the fish or agricultural commodities are gathered for shipment.*"

Another bill[34] which would effect sweeping changes in Section 203(b)(6) was introduced in the Senate by Senator Smathers on July 15, 1957. The amended section would read as follows:

"(6) motor vehicles used in carrying property (when such property is not transported in the same vehicle with any other property, or passengers, for compensation) consisting of (a) fish (including shellfish); (b) ordinary livestock, as defined in section 20 (11) of this Act; (c) leaf tobacco (not including redried tobacco); (d) nuts (not including shelled peanuts); (e) live poultry and raw eggs in the shell (not including frozen eggs); (f) domestic wool and mohair (not including cleaned or scoured wool or mohair); (g) fresh, pasteurized, fortified, standardized or homogenized milk, cream, skimmed milk, buttermilk or whey (including concentrated or condensed products thereof when shipped in

[32] S. 1689 and H.R. 5823.
[33] See footnote 2.
[34] S. 2553.

milk shipping cans not hermetically sealed, or in bulk in tanks, but not including canned, churned, dried or powdered milk, cream, skimmed milk, buttermilk or whey or other manufactured products thereof); or (h) other agricultural or horticultural commodities (not including manufactured, cooked, canned, frozen, powdered, dehydrated, evaporated, condensed, concentrated, milled or pearled commodities or products thereof, or chilled juices or fruit salad)."

A bill[35] was also introduced in the House in this session to broaden the exemption by including in it fertilizer and fertilizer materials.

All of these bills are now (April, 1958) before the Committee on Interstate and Foreign Commerce of the respective houses where they were introduced. No action has yet been taken on any of them.

The legislative history of the exemption was summed up by Judge Henry N. Graven of the Federal District Court for the Northern District of Iowa in his decision in the Kroblin case on fresh dressed poultry. His words, written in 1953, still hold true: "There are two features that stand out predominantly in the voluminous legislative history relating to amendments made or proposed to Section 203(b)(6). One feature is that every amendment that Congress has made to it has broadened and liberalized its provisions in favor of exemption, and the other feature is that although often importuned to do so, Congress has uniformly and steadfastly refused or rejected amendments which would either directly or indirectly have denied the benefits of the exemptions contained therein to truckers who are engaged in operations similar to that of the defendant herein. It is believed that the actions and attitude of Congress as manifested in connection with amendments to Section 203(b)(6) are preponderantly indicative of an intent on the part of Congress that the words 'manufactured products' used in that subparagraph are not to be given the restricted meaning contended for by the Interstate Commerce Commission herein."

[35] H.R. 5765.

OUTPUT IN RELATION TO INPUT FOR THE AGRICULTURAL INDUSTRY*

EARL O. HEADY
Iowa State College

INCREASINGLY, the problem of commercial agriculture has been recognized as one of input and output magnitudes. Output has been large relative to demand, and input has been large relative to the total income available to be imputed to resources. Consequently, returns to labor and other resources in agriculture have been low, as compared to other industries. The purpose of this paper is to explore further the relation between input and output, with particular emphasis on changes in the output/input ratio. More particularly, recent propositions relating to the latter phenomenon are examined, and alternatives are explored.

Input Relative to Output

It has been possible in recent decades, measured by the accounting convention of indices based on constant dollar capital, to increase agricultural output by a much greater proportion than the increase in aggregate resource inputs. T. W. Schultz has posed this essentially physical production phenomenon as a mystery yet unsolved.[1] How, he asks, can output have increased relative to inputs? Are there some mysterious input categories which have eluded measurement and which account for this increase in output without a parallel increase in input?

He suggests that one difficulty is the use of the classical input categories of land, labor and capital; then he proceeds to base his inferences largely on this very classification—since capital, transformed on the basis of a constant dollar value, is used in his weighting system. But in the physical world, it is known that the economist's transformation of most material resources into a single value or capital quantity or index does not conform to the reality of the production process. Individual items within this gross category of capital differ more in their relation to the production process than do the conventional resources, land, labor and capital. While on the basis of highly aggregated, dollar-weighted (at least for the capital component) indices, inputs have not increased by the same proportion as outputs; some resources (e.g., hybrid corn, fertilizer, tractor fuel, insecticides, etc.) have increased by extremely large amounts; others (e.g., open-pollinated corn, horse feed, walking

* Journal paper No. J-3294 of the Center for Agricultural Adjustment, Iowa Agricultural and Home Economics Experiment Station, project 1135. The author is indebted to Harold Carter and John Nordin for helpful criticism of an earlier draft.

[1] Schultz, T. W., "Reflections on Agricultural Production, Output and Supply," *Journal of Farm Economics*, Vol. 38, August 1956, pp. 748-762.

cultivators, various types of hand labor, etc.) have decreased by equally large amounts. With relatively high substitution rates and relatively low prices for these new resources, it has been *physically simple* for output to increase without a similar increase in total value of inputs, particularly when demand elasticities have been at low levels serving to check agricultural output.

The possibilities for these phenomena have been long known to economists. Empirical agricultural economics had its "kick off" with farm management studies showing that groups of farmers using particular resource combinations had a greater output per input unit, or had a greater output from the same or a smaller total input, than did other groups of farmers using a different resource mix. Early studies showed that the labor and management income of farmers using quantities and combinations of materials representing less costly techniques, or farmers who produced more product with the same physical quantity of resources and adapted their output mix to consumer demand, had greater labor or capital returns than farmers who did not have (a) input mixes of similar low cost and/or (b) output mixes of similar high value. Computed as residual quantities, the higher labor and management returns were simply an indication that the better managers (those who used more of particular resources such as protein feed for hogs, seed planted at the appropriate date, etc.) produced a larger weighted output with the same or a smaller weighted input than did farmers who used more of other resources (corn without protein for hogs, seed without treatment, seed planted at the wrong time, varieties and breeds from the old days, etc.).

These facts were long known and were attributed to managerial differences (i.e., skills of the agricultural labor force).[2] It is obvious from this starting point in agricultural economics that possibilities existed, with an increased flow of new techniques from public institutions and private firms, for agriculture to produce more output with relatively fewer resources. Land Grant College education to move "less efficient" farmers to the position of the "more efficient" farmers would itself provide this result. The state of affairs which existed at a point in time between strata of farms could be reflected in the aggregate over time under even moderately efficient educational programs and communication media and a continuous flow of new techniques.

Even in economic theory, the void in logic explaining these phenomena has not been as great as Schultz would lead us to believe. Nearly two

[2] Certainly, managerial skill, the quality of the human resource has increased over the past several decades. This has been one goal of Land Grant College education. It is this aspect of improvement in the farm labor force, rather than its ability to exert more physical effort or manual dexterity, which has been important.

decades back, Hicks, Lange and others provided details on the nature of factor saving innovations and their impact on inputs through substitution and price effects.[3]

The purpose of the sections which follow is to review additional conditions of agriculture and concepts in economics which might obviously explain an increase in output without a proportionate increase in value aggregated input. No great mystery is involved.

Nonfarm Inputs

To be entirely accurate, an index of farm inputs certainly should include industrial resources which serve indirectly as factors to agriculture. Part of buildings and materials in the steel industry used to produce farm tractors is as much an agricultural input as oats grown to feed horses in 1910. Similarly, a portion of the labor used for drilling dry holes in the oilfields of Texas and Venezuela, with the market being tractor fuel, is an agricultural input as much as was labor used to produce open-pollinated corn in 1932 or the time of the mechanic who services farm tractors. Increasingly, fabrication of farm resources has moved to nonfarm industries. Examples are the production of power, fuels and materials for power, the farm fertilizer and chemical industry, processing of feeds, and others. Too, some of the processing of farm products formerly performed in agriculture is now handled by the food processing industry. Certainly these resource services should be included in any index calculated to measure the intertemporal relationship between input and output of agriculture. We doubt that inclusion of these factors which "have moved from the farm" would completely fill the input gap which Schultz has in mind. And while transfers of these activities, which are farm inputs (even if they don't bear the label), to industry do not affect the arguments which follow, they should not be overlooked in a complete accounting of inputs which are transformed directly and indirectly into agricultural products.

The Production Process

The mystery of "where went the rest of the inputs" also is partly solved if we examine the nature of the production process. It is obvious that the production process is not adequately represented by a production function in which there are only three factors of production, capital, labor and land. It is better represented by a production function such as

$$\overset{*}{q} = f(x_1, x_2, x_3, \cdots x_{100} \cdots x_n)$$

[3] *Cf.* Hicks, J. F., "Distribution and Economic Progress," *Review of Economic Studies,* Vol. 4; Lange, Oscar, "A Note on Innovation," *Review of Economic Studies,* Vol. 25.

where $\overset{*}{q}$ is output and there are hundreds of resources, x_i, or possible categories of inputs. Some of these resources are known, and if their price has not been too high relative to their productivity, they have been used in positive quantities. Some of these resources are unknown, and therefore their input is zero at the present time. Input of others was zero for centuries and decades simply because they, or their productivity coefficients, were not known but increased rapidly as technical innovation identified them. There are, in nature, hundreds of individual resources which represent the agricultural production function. The role of technical innovation is to identify these individual resources and their productivity coefficients, so that they can be used in non-zero quantities if prices are favorable. Granulated ammonium nitrate, 2-4-D, Pioneer 907 hybrid seed corn, row crop tractors and irrigation water in Indiana are resources distinctly different from rock phosphate, pig weeds, open-pollinated or Best 206 hybrid seed corn, mules and winter snow in Indiana. The production process is not adequately or accurately represented and explained if we aggregate these many different resources into a single resource category, capital or value of inputs, and try to explain changes in the physical production function (i.e., the relation of output to input). These distinctly different resources, some known and some yet unknown, serve as substitutes for each other. Input of some has increased by extremely large magnitudes over the past several decades, with a consequent decrease or disappearance in others.

Innovations would not be adopted if they did not lessen the value of inputs (the measure conventionally used to indicate aggregate magnitude of inputs) required to produce a given output. We have, then, one obvious reason why continuous innovation would lead to a decline in capital value of inputs, relative to output. For an individual farmer, and in aggregate for the agricultural industry, the situation is about like that represented in Figure 1. We could examine the case in which (1) both an individual form of resource (technique or capital form) and its productivity coefficient are unknown or (2) the material or resource (hybrid corn) is known but its productivity coefficient (yield effect) is not. For simplicity purposes, we use the second example, although the logic is the same in both. First, suppose that one particular resource (material or practice such as open-pollinated corn or horse power) in the *total* production function is known and is X_g. Another particular resource (material or technology such as hybrid corn or tractors) has been newly discovered or identified (discovered technically) and is X_h. However, nothing is known about its productivity coefficient. Therefore, the product isoquant in Figure 1, denoting substitution rates between the two distinct resources or materials, is unknown. Hence, the amount of X_g used to produce the given quantity should be a, if profits are maximized in

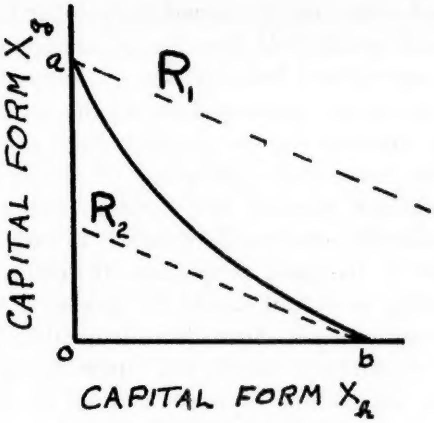

FIGURE 1

the situation. Although both materials may have a price, with the price ratio represented by the slope of R_1, only resource X_g should be used because the effects of resource X_h are unknown. Now suppose that technical research uncovers the productivity coefficient and establishes the isoquant ab. Given the price ratio indicated, costs can be lowered (the amount of capital or value quantity of all inputs can be decreased) and profits increased by substituting resource X_h (hybrid corn or ammonium nitrate) for X_g (open-pollinated corn or ammonium sulfate), to the extent of b. In doing so, capital resources measured in dollar value will decline from the level R_1 to R_2. In other words, input of a particular resource, X_h, increases by an infinitely large proportion but capital, measured in the conventional dollar sense, declines for the given output. We need no new theory or arithmetic to explain why dollar inputs for any given output, or aggregate inputs weighted on the basis of dollar transformations, can decline relative to output. While using less sophisticated paraphernalia, farmers figure this out for themselves and lower "capital value inputs" for any given output. They would be foolish indeed to substitute one physical resource for another (i.e., adopt new techniques) which increase "value inputs" for any given output. For this reason, the one physical resource is substituted for another in producing a given output, and the basis is laid for producing more output without a similar increase in "dollar aggregated" input. The "why" of our ability to increase output without a parallel increase in value input is partly explained.

But in addition to a substitution effect, a price effect, in respect to quantity of output and resources used after the innovation, is expected. In this case, output can expand with a smaller "dollar capital input" as long as the equilibrium production is less than that denoted by an isoquant tangent to R_1. Given the particular geometry, output could be

more than doubled, while inputs valued on a dollar basis would show a decline. That which would hold true for an individual farm could also hold true for the agricultural industry. Or, if a curved isorevenue line is assumed, the figure would apply equally to the industry. Of course, if price elasticity of demand for the product were sufficiently great, the price effect of the innovation (discovery of the new resource form) could cause a sufficient increase in output to also cause dollar value (capital as conventionally measured) of inputs to increase, but the latter would not increase by the same proportion. If demand were sufficiently inelastic, the increase in output would be produced with a proportionately smaller increase in input. Agriculture is notably "low" in respect to demand elasticity coefficients. Given this situation and the simple logic outlined above, we see nothing mysterious about the fact that output of agriculture might increase while aggregate input, as measured by some index based largely on "dollar capital" or value of aggregate inputs, declines relatively. Logically, the explanation of the physical and economic possibility of an output which grows relative to input appears extremely simple.

To better illustrate, however, that concepts already exist to explain why output might increase at a greater rate than input, given the situation of demand elasticity and technical advance of agriculture, a very simple algebraic example is now used. It further illustrates that the phenomenon of concern might be readily explained by classical concepts in economics without need to resort to a yet undeveloped growth theory. A simple model with some numerical coefficients is used for simplicity and ease of following by the reader, but other algebraic forms and coefficients would give similar results under the elasticity and technical conditions which characterize agriculture. (The example used, while less general than more complex models which might be presented, is kept relatively simple so that it can be followed by more readers.) First, we suppose a demand function as in (1), with quantity expressed as a function of price. (We might consider the demand and production functions to relate to a particular product or to products in aggregate. The results, in respect to magnitude of output relative to input, are the same in either case for elasticities and changes such as those used for illustration.) For illustrative purposes and to lessen the abstract nature of the illustration, we suppose a demand elasticity of .4. Other variables in the demand function are q, the amount purchased at any particular price, p, and a, a constant to reflect the effects of income, population magnitudes and related variables at a particular point in time.

(1) $$q = ap^{-.4}$$

The production function used for illustrative purposes is that of (2) where

$$\overset{*}{q} = bx_g^{.8} \tag{2}$$

$\overset{*}{q}$ is the amount of product, x_g is factor input and b is a coefficient to reflect the effects of a quantity of fixed resources and technical conditions at one point in time. The elasticity of production used for illustrative purposes is .8. The variable x_g refers to resources used in the form of particular techniques at one point in time. It could be a quantity measured by some standard such as mass (tons) or value (constant dollars). The elasticity of .8 is arbitrary, taken to illustrate a fixed plant in acreage for a given state of arts.[4] Hence, at a given point in time, an increase in quantity of inputs representing given techniques would result in an increase in output by a smaller proportion.

We now express input requirements as a function of output as in (3), which is derived from (2). The g subscript indicates that resource input is in a form representing an early stage of innovation (open-pollinated corn, horses, oats without cerasan treatment, etc.). Obviously, as the state of the arts increases (b becomes larger), a smaller quantity of resources, x_g, will be required to produce

$$x_g = b^{-1.25}\overset{*}{q}^{1.25} \tag{3}$$

a given amount of product because b has a negative exponent in (3).

Using the value of x_g in (3), we now derive total cost, C, as a function of output in (4), where c is the cost (price) per unit of the resource.

$$C = cb^{-1.25}\overset{*}{q}^{1.25} \tag{4}$$

As a step towards a "supply" function, indicating the classical equilibrium of output relative to demand, we derive marginal cost, m in (5), as

$$m = 1.25cb^{-1.25}\overset{*}{q}^{.25} \tag{5}$$

the derivative of (4). From the standpoint of supply, we substitute p, the product price, for m, the marginal cost, in (5). Hence, we derive the classical short-run supply function in (6) from (5), where $\bar{q}$ is the amount produced at any given product price, p.

$$\bar{q} = .4096c^{-4}b^5p^4 \tag{6}$$

Given the demand function in (1) and the supply function in (6), we

[4] By using an elasticity of production smaller than 1.0, we do not assume diminishing returns over (to) time. As illustrated later, innovations can (as actually experienced in agriculture) allow output to increase by a greater proportion than inputs.

equate supply and demand as in (7), as a basis for deriving equilibrium inputs and outputs under a given situation in respect to demand and technology.

$$ap^{-.4} = .4096c^{-4}b^5p^4 \tag{7}$$

From (7) we derive (8) and thus (9) where p′ is the equilibrium price,

$$p^{4.4} = 2.4414ac^4b^{-5} \tag{8}$$

$$p' = 1.2249a^{.2273}c^{.9092}b^{-1.1365} \tag{9}$$

depending on c, the magnitude of factor price, a, the state of demand and b, the state of technology. Substituting p′ from (9) for p in (6), we derive the equilibrium industry output in (10).

$$\bar{q} = .9223a^{.9092}c^{-.3632}b^{.4540} \tag{10}$$

Now substituting the $\bar{q}$ in (10) for $\overset{*}{q}$ in (3), we obtain (11), indicating the amount of input, x_g, required for the equilibrium output.

$$x_g = .9037a^{1.1365}c^{-.4540}b^{-.6825} \tag{11}$$

The equilibrium output/input ratio is that in (12), which represents an index of 100 for this base period.

$$\frac{\bar{q}}{x_g} = 1.0204a^{-.2273}c^{.0908}b^{1.1365} \tag{12}$$

Now suppose that demand growth takes place as population and national income increase. Further, technical advance changes the production function: More product is obtained from a given tonnage, value (on a constant dollar basis) or other unit of input. The demand function increases by the proportion α, to that in (13).

$$q = \alpha a p^{-.4} \tag{13}$$

Similarly, resource productivity increases by the proportion β, to give the production function in (14) where the subscript h now reflects the new forms of resources,

$$\overset{*}{q} = \beta b x_h^{.8} \tag{14}$$

converted to mass (tons), value (constant dollars) or other common units of measurement. The proportionate increase in equilibrium output, r_q, resulting from the increase in demand and improved technology, is that in (15), given the demand and

$$r_q = \alpha^{.9092}\beta^{.4540} \tag{15}$$

production elasticities used. The proportionate increase in equilibrium input, r_x, is that in (16). These two proportions (i.e., rates of increase in output and input)

$$r_x = \alpha^{1.1365}\beta^{-.6825} \tag{16}$$

are the same only under the condition of (17), indicating that the rate of increase

$$\beta = \alpha^{.2} \tag{17}$$

in resource productivity, resulting from technical improvement, must be much smaller than the rate of demand increase—if the rate by which equilibrium input increases is the same as the rate at which equilibrium output increases. Thus, if the proportionate increase in demand were 1.5 (i.e., the demand function in (1) were increased by 1.5) as a result of increases in population and income, the production function could increase only by the much smaller fraction or by 1.08; the production function in (2) could be multiplied by only 1.08 if ratios of increase were to remain the same.

As a further example, suppose that α in (13) is 1.5 while β in (14) is 1.65, indicating that demand and resource productivity have increased by these proportions. The output and input quantities will now be those in (18) and (19), respectively, as compared to those in (10) and (11) before the improvement in demand and technology.

$$\bar{q} = 1.6728a^{.9092}c^{-.3632}b^{.4540} \tag{18}$$

$$x_h = 1.0170a^{1.1365}c^{-.4540}b^{-.6825} \tag{19}$$

In other words, equilibrium output is 1.82 times (82 per cent) greater than before the improvement in demand and technology, while equilibrium input is only 1.13 times (13 per cent) greater. Obviously, the relative rate at which output and input increase, given a rate of increase in demand and physical resource productivity, depends on the elasticity coefficients. The output/input ratio has increased from that in (12) to that in (20) or by 37 per cent. (The index now stands at 137 as compared to the base period.)

$$\frac{\bar{q}}{x_h} = 1.6448a^{-.2273}c^{.0908}b^{1.1365} \tag{20}$$

The magnitudes of the elasticity coefficients and the demand and production multipliers concerned have caused inputs to increase by a smaller proportion than output. It is obvious that the relative rate at which inputs and outputs change, with given changes in demand and techniques, will depend on the production and elasticity coefficients. Or, with given elasticity coefficients, the relative rate of increase between output and input will depend on the rate of growth in demand and technical advance. The change in ratio of output to input will be greater as the price elasticity of demand is lower or as the elasticity of production is

greater. If the elasticity of production is sufficiently great relative to β, input can even decline while output is increasing. Or, if the price elasticity of demand is sufficiently low, an improvement in techniques which results in a higher transformation rate for resources (measured in some standard unit such as dollars, tons, etc.) and a greater elasticity of production, output can increase while input (measured in the standard units) is decreasing.[5] For simplicity purposes in our example, demand and technical change are reflected through the two multipliers, with the elasticity coefficients remaining constant. Actually, the tendency is for price elasticity of demand to decline with growth in income and perhaps for the agricultural production elasticity to increase with technical innovation. Incorporation of these changing elasticity coefficients into the example would cause the growth in input to be restricted even more relative to growth in output.[6]

The coefficients in the example are not presented as the empirical quantities for agriculture (a larger model is being used in empirical work, but it is too complex for simple presentation) but to illustrate major quantities and coefficients relevant for analyzing input changes relative to output growth. These coefficients, relative to increases in demand and resource productivity experienced over the last several decades, are the major ones responsible for a faster growth in output than in agricultural input. Derivation of these quantities for the aggregate agricultural industry, in more complete models, will allow empirical specification of why output has grown at a more rapid rate than input. This will also prove greatly more productive than Schultz's criticism[7] of linear programming and production functions studies for not having provided these answers (when the techniques have not been directed at all to explaining changes in the aggregate output/input ratio).

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[5] For example, if we start with the demand and production functions in (1) and (2) and increase the demand function by the ratio $\alpha = 1.3$ and the production function by the ratio $\beta = 2.0$, equilibrium output will increase by the ratio $r_q = 1.7388$ or by 73.9 per cent while equilibrium input will decrease by the ratio $r_x = .8333$ or by 16.7 per cent. This is true, for the elasticity coefficients used, because $\beta > \alpha^3$. In other words, equilibrium input can decline absolutely while output increases if the elasticity of production and β, the change in technology, are sufficiently great relative to the demand elasticity and α, the demand multiplier. Of the several examples, that in the text comparing (10) and (11) with (18) and (19) best parallels that of American agriculture.

[6] We determined equilibrium output and input in the classical example which did not allow for discounting due to uncertainty and other causes. However, even if a discount coefficient were attached to the supply functions before and after innovation, the result would be the same for equal discounts. Even with a growth in the discount coefficient, output could still increase more than input, if the rate of technical improvement and the elasticity of production are sufficiently large.

[7] Schultz, op. cit., pp. 748 and 750.

Constant Ratio of Output to Input

Schultz mentions that an ideal situation would be one where output over input is constant with time.[8] But ideal for what? If society could alter the production environment to the extent of attaining a specific relationship between output and input, the ideal would be to have the ratio of output to input increase with time. More goods and services would then be available from given resources. The only possible reason for maintaining output/input ratios of unity would be for purposes of statistical charting.

There are two general cases under which the output/input ratio would remain constant (i.e., the index of output divided by the index of input would remain at unity) over time. One is the case of constant resource productivity (an elasticity coefficient of 1.0) and no improvement in techniques as demand increases. The other parallels that in (17) where production elasticity is not unity and the improvement in technology must bear some particular relationship to the increase in demand, given the elasticity coefficients. But in neither of these cases, with the ratio of output to input remaining constant, or the ratio of increases remaining at unity, would society in general gain, as compared to the case in which the output/input ratio increases with time. For example, starting with the first case, if the original demand is that in equation (1) while the production function is $\mathring{q} = bx_g$, an elasticity coefficient of unity, the equilibrium output will be $ac^{-.4}b^{.4}$ and equilibrium input will be $ac^{-.4}b^{-.6}$. The equilibrium output/input ratio then is

$$\frac{ac^{-.4}b^{.4}}{ac^{-.4}b^{-.6}} \text{ or } b.$$

Now, if demand increases by the proportion α (to give the demand function $q = \alpha ap^{-.4}$) while technical improvement does not take place, the equilibrium output will increase to $\alpha ac^{-.4}b^{.4}$ and equilibrium input will increase to $\alpha ac^{-.4}b^{-.6}$. The equilibrium output/input ratio will remain constant at the original value of b. But of what value is this? Society would gain more if technical change also could occur at the rate of β, so that the output/input ratio could increase to βb, rather than to remain constant at b. Then for a given agricultural output, $\mathring{q}$, for consumers, an amount of resources equal to $\beta^{-1}x_g$ could be transferred to production of other goods and services.

As a second case, with the elasticity of production not at unity, suppose that demand and production functions are originally those in (1) and (2).

[8] Ibid., pp. 758 and 762.

Now suppose that through demand increases, α in (13) becomes 1.5 and through technological improvement, β in (14) becomes 1.0845. Under this very small improvement in technology, equilibrium output will be that in (21) while the equilibrium input will be

$$\bar{q} = 1.3825a^{.9092}c^{-.3632}b^{.4540} \tag{21}$$

that in (22). The new equilibrium output/input ratio will thus remain constant at

$$x_h = 1.3548a^{1.1365}c^{-.4540}b^{-.6825} \tag{22}$$

the level in (12), and the index ratio, output index over input index, will remain at unity. This condition was attained by holding technical improvement at a very low level. However, it is not desirable from an economic welfare standpoint. The same output could be attained with a saving of resources if we caused the output/input ratio to increase through a more rapid pace in technical improvement. In fact, the output in (21) could be attained by an amount of resources equal to

$$x_h = .8017a^{1.1365}c^{-.4540}b^{-.6825} \tag{23}$$

if we allowed β to be 1.65, as for (19), rather than to restrict it to 1.0845.[9] In other words, we could save the proportion

$$1 - \frac{.8017}{1.3548} \text{ or } 44.9 \text{ per cent}$$

of the resources used in producing (21), if we allowed the output/input ratio to increase to the level consistent with $\beta = 1.65$, rather than to hold it constant at the level of $\beta = 1.0845$ for (12). Obviously, it is economically more desirable to have the index ratio, index of output divided by index of input, increase with time (i.e., depart from unity) because it is then possible to get a given percentage increase in output, to meet increased demands, with a smaller percentage increase in inputs. In this sense, the ideal index ratio over time is not unity as Schultz suggests, even though retention of this constant index would provide an accounting nicety.

Other Causes

Other practical forces also help explain why the output index has increased relative to the aggregate input index. One is that of scale or cost economies and farm consolidation. Institutional forces have long served to prevent farms from adjusting to sizes consistent with a unit cost minimum. It also is evident that over recent decades individual

[9] Computed by setting $1.65bx_h^{.8} = 1.3825a^{.9092}c^{-.3632}b^{.4540}$ and solving for x_h where the left hand quantity is from (14) with $\beta = 1.65$ while the right hand quantity is $\bar{q}$ in (21), the equilibrium output where we hold technical change to $\beta = 1.0845$.

farms of average size in major sections of the United States have not been large enough to fully realize scale economies under existing techniques. Further, it is known that farms have been consolidated at a fairly rapid rate over the last three decades, with numbers declining by nearly a third and acres per farm increasing by about 50 per cent in the period 1930-54. The simple concepts of scale returns and long-run cost functions lead immediately to the conclusion that a declining number of farms could allow more output with fewer resources. As two farms of (say) 160 acres are consolidated, the consolidating unit need not double labor and capital inputs, even though it has doubled output and land input. Unpublished studies in Iowa show, under the economies associated with available techniques (hence, an underemployment of labor and machine capital), that consolidating farms can maintain or increase output from both land areas with less labor and machine capital than required by the two separate units. Farm consolidations also allow more output from fewer inputs because the process tends to drain off the less skilled managers in commercial farming areas. (Relative income disadvantage is greatest for operators who possess small amounts of capital and managerial skills.) Illustrating these possibilities is a study in southwestern Iowa, an area about average for the Cornbelt in respect to yield. Farms consolidated typically are operated by remaining farmers, with only a slight increase in labor and capital of their own; the total employed on the combined units being less than for the separate units. Remaining operators apply more yield-increasing techniques and have higher yields than those who leave agriculture. They have higher yields on the same land, and most remaining farmers add no machinery; or only special equipment.

The gradual trend toward specialization in farming also is a phenomenon allowing more output relative to input. In reducing numbers of enterprises, farmers can expand those retained and better realize existing scale economies, or the cost economies associated with fixed assets. This possibility is about the same as for consolidation of two farms which are operating in the range of increasing scale returns or on the negatively sloped portion of a cost curve.

PLANNING EFFICIENT OPERATIONS FOR CHERRY PROCESSING PLANTS*

Vernon L. Sorenson†
Michigan State University

TWO principal methods have been used to evaluate the operating efficiency of agricultural marketing firms. These are: 1) the older and more familiar statistical studies, which express average cost as a function of the rate of output, and 2) the more recently developed approach which relies on engineering and technical data as the primary building blocks from which the most efficient firm is synthesized. Studies using both of these approaches are basically input oriented and have been developed with the assumption that the composition of both raw material inputs and products outputs are given. These assumptions are in many cases valid, and in such situations obtaining lower unit costs through efficient use of plant facilities and labor, and obtaining adequate gross volume are the principal operating problems facing management in both long run and short run planning spans. In many other processing firms, however, management is, in addition, faced with the problem of determining for any given planning period which of several or many combinations of raw products should be used to produce a given product, or which of several or many products should be produced from a given raw product. The first of these problems has been analyzed in recent studies of feed mixing, while the latter has been analyzed in gasoline blending problems.[1] A problem of the type where flexibility exists which permits a range of choice in determining plant output is the concern of this article.

Though the specific situation facing individual managers will vary in detail, the general nature of all problems of product composition is the same. A group of limiting or restricting conditions must be taken into account in determining output policy in order to obtain an optimum

* Journal article No. 2171, Michigan State Agricultural Experiment Station.

† I am indebted to C. Hildreth and D. McKee for reviewing this paper and providing helpful criticisms and suggestions.

[1] The principal studies include F. V. Waugh, "The Minimum-Cost Dairy Feed," *Journal of Farm Economics*, Vol. 33, August 1951, pages 299-310; W. D. Fisher and L. L. Schruben, "Linear Programming Applied to Feed Mixing Under Different Price Conditions," *Journal of Farm Economics*, Vol. 35, November 1953, pages 471-483; E. R. Swanson, "Solving Minimum-Cost Feed Mix Problems," *Journal of Farm Economics*, Vol. 37, February 1955, pages 135-139; I. Katzman, "Solving Feed Problems Through Linear Programming," *Journal of Farm Economics*, Vol. 38, May 1956, pages 420-429; and A. Charnes, W. W. Cooper, and B. Mellon, "Blending Aviation Gasoline—A Study in Programming Interdependent Activities in an Integrated Oil Company," *Econometrica*, 20, 135-159; 1952.

over-all production program. Further, all decisions concerning the output of individual products are interlocking because they must be made with certain common sets of limitations. These limitations may be set by physical plant capacities, by capital requirements, market limitations, or management policy. When there are only a few possible courses of action or if only a limited number of effective overlapping restrictions exist, the best program can usually be found with informal analysis or simple budgeting supplemented by the judgment of persons well acquainted with market conditions and plant operations. However, where several or many economically different products can be produced or where several limiting conditions must be accounted for, a more formalized procedure can be very helpful.

Where formal procedures can be used, they provide a method of deriving inferences about the consequences which will follow from an initial set of assumptions and empirical conditions. Two kinds of benefits may result. The chance of logical error in the reasoning or analytical process is lessened and the burden of time and effort which management personnel puts into "feeling out" the situation can often be greatly reduced. Both the greater precision which is obtained and the economy of effort to administrative personnel will tend to intensify the potential of the decision making role which managers must perform and hence contribute to better management.

Included amongst a rather wide range of agricultural marketing firms where operating relations are complex enough to warrant the use of formal analytical procedures in planning production programs are firms which handle and process fruits and vegetables. One of the most complex problems of product composition and production planning arises in plants which are equipped to process cherries into a wide variety of finished forms.

Managers of these plants are faced with a large number of alternative "production activities" which can theoretically be combined into an infinite number of different production programs. Within specified ranges of conditions linear programming represents a method of selecting the one best program from this theoretically infinite range of possibilities. Further, linear programming is flexible enough to handle, again within certain limitations, changes in the initial conditions which are stipulated in making the original program selection. It is possible, for example, to program the operating adjustments required to satisfy varying market levels or varying levels of resource restriction.[2] These adjustments can

[2] The method for making these and certain other kinds of adjustments have been set forth by Hildreth in a paper entitled, "Some Problems and Possibilities of Farm Programming" presented at the 1956 TVA conference on fertilizer innovations and resource use. See E. L. Baum, Earl O. Heady, John T. Pesek, and Clifford Hildreth,

be made on a continuous basis and can be introduced at later stages of the solution. The practical importance of this flexibility lies in the fact that many policy decisions are contingent upon market conditions or other phenomena which can be predicted only within wide ranges of uncertainty prior to the production period. Decisions which are in error due to inaccurate predictions can be re-evaluated rapidly to meet changing conditions without complete reprogramming.

The Problem and Its Setting

To plan operations for cherry processing plants it is necessary to take into account both plant operating relations and market conditions. Both are important in developing the frame of reference which management must use in arriving at output decisions. Most of the cherries processed in Michigan are received at the plant in the comparatively short period of two to three weeks during mid or late summer. Consumption on the other hand reaches its seasonal peak in January and continues heavy through May or June.[3] This means that production decisions must be made far in advance of the period of heaviest sales. The range of products which can be produced by any particular plant varies widely. Some larger plants are prepared to produce a wide variety of products including pie fillings, both frozen and hot packs of canned whole cherries each with several can sizes and packing media, and miscellaneous jellies and preserves. Other plants maintain only one line and produce a single pack usually, in this case, 30 pound frozen tins.

The plant used in this problem has five operating lines and can produce a wide variety of both frozen and hot packs. It has facilities for handling both sweet and sour cherries. It does not produce miscellaneous jellies and preserves.

Pre-season planning for management includes establishing estimates of the potential quantity of raw material available, and from this and the market outlook (however imperfectly known) a basic production plan is derived. Later adjustments may be made if market outlook changes, or if the available supply of raw materials differs greatly from the estimated quantity. The planning problem can be fit into a programming framework by establishing a budget based on technical plant relations and on anticipated or potential market and raw product quantities. Budgeting procedures can be handled on the basis of market season, weekly or daily input-output quantities. The solution developed here is based on a daily

Fertilizer Innovations and Resource Use, Iowa State College Press, 1957, pp. 243-260. Since none of the other adjustments suggested by Hildreth represent major problems to cherry processors they will not be introduced here.

[3] B. C. French, "Trends and Characteristics of Red Cherry Consumption," Michigan State University, Special Bulletin 414, March 1957.

budget assuming the use of two 10-hour shifts. Actual running time with breaks for meals and shift changes is 18 hours. With this running time the daily resource and market limitations are as shown in Table I.

TABLE 1. DAILY PLANT CAPACITIES AND MARKET LIMITATIONS

Item	Unit	Daily Capacity	Product	Unit	Daily restriction
			Hot pack		
*Line 1	100 cans	2,160.0[1]	No. 303 Heavy Syrup	Cases	1320.5
*Line 2	100 cans	2,160.0[2]	No. 2 Heavy Syrup	Cases	1152.0
*Lines 3 and 4	100 cans	604.8[3]	No. 10 Heavy Syrup	Cases	767.8
*Line 5	100 cans	194.4[4]	No. 303 Light Syrup	Cases	6771.7
*Pitters (RSP)	Cwt.	10,360.0	No. 2 Light Syrup	Cases	5909.8
*Pitters sweet	Cwt.	1,344.0	No. 10 Light Syrup	Cases	3937.0
*Syrup Prod.	Hrs.	18.0	No. 2 Water	Cases	2580.3
**Capital	100 dol.	2,000.0	*Frozen Pack*		
**Raw Prod. (RSP)	Cwt.	10,000.0	No. 303	Cases	1198.4
**Raw Prod. (Sweet)	Cwt.	126.8	No. 2	Cases	6954.4
**Freezer capacity	Cwt.	2,000.0	No. 10	Cases	871.7
**Other storage	Cases	20,666.0			

[1] Line 1 produces either No. 303 or No. 2 size cans.
[2] Line 2 produces only No. 2 size cans.
[3] Lines 3 and 4 produce only No. 10 cans.
[4] Line 5 produces only 30 pound tins.
* Actual physical capacities.
** Budgeted daily limitation based on normal crop size of approximately 12 million pounds.

These restrictions were established in three separate ways. The items in Table I noted by a single star represent simply daily physical plant capacities. The items noted by a double star are based on estimated daily requirements in a normal crop year. Their magnitude within certain ranges depend on expected crop size.[4] The market restrictions are based on management policy and estimated market limitations. The number of commodities produced by this firm increased from eight in 1953 to 12 in 1955. Management policy is oriented toward diversification but with definite quantity limitations on minor or new commodities.

The initial budget of resource use coefficients and net revenue at the unit level are shown in Table II. This table is a statement of the quantity of resources used and the net revenue available from the product produced with 100 lbs. of pitted cherries. Such variables cost items as cans, cartons, sorting labor, cherries at 5¢ per pound, and miscellaneous other expenses have been deducted from the gross value of product to obtain net revenue. Average product prices, f.o.b. plant for commodities produced in 1955 were used to calculate gross market value.

[4] The exception occurs when crop size and hence estimated plant receipts become so small that some or all of these items cease to be limitational. This happens on occasional years when heavy frost damage reduces the crop to a small fraction of normal.

TABLE 2. RESOURCE REQUIREMENTS AND NET REVENUE AT UNIT LEVEL OF OUTPUT FOR PRODUCTS PRODUCED

Product	Line capacity (100 cans)	Pitter capacity (cwt.)	Storage (cases)	Syrup capacity (hours)	Capital (100 dollars)	Raw product (cwt.)	Market capacity (cases)	Net revenue per unit
Sour cherries								
No. 303 light syrup	1.33	1.14	5.52	.01	.16	1.22	5.52	4.20
No. 303 heavy syrup	1.29	1.14	5.39	.01	.16	1.22	5.39	8.11
No. 303 water pack	1.29	1.14	5.36	0	.14	1.22	0	6.15
No. 2 light syrup	1.16	1.14	4.82	.01	.16	1.22	4.82	4.69
No. 2 heavy syrup	1.13	1.14	4.70	.01	.16	1.22	4.70	8.53
No. 2 water pack	1.01	1.14	4.21	0	.13	1.22	4.21	4.60
No. 10 light syrup	.19	1.14	3.21	.01	.12	1.22	3.21	4.24
No. 10 heavy syrup	.19	1.14	3.13	.01	.12	1.22	3.13	8.10
No. 10 water pack	.18	1.14	3.06	0	.11	1.22	0	3.89
30 lbs. tins	.04	1.14	1.20	0	.11	1.22	0	3.42
20 oz. frozen	1.02	1.14	1.27	.01	.16	1.22	4.25	6.26
No. 303 frozen	1.17	1.14	1.17	.01	.16	1.22	4.89	6.84
No. 10 frozen	.21	1.14	1.39	.01	.15	1.22	3.56	5.21
Sweet cherries								
No. 303 pitted	1.45	1.43	6.03	.01	.23	1.06	0	11.72
No. 303 unpitted	1.49	0	6.23	.01	.20	1.44	0	11.91
30 lbs. tins pitted	.04	1.43	1.20	0	.14	1.06	0	9.48
30 lbs. tins unpitted	.05	0	1.36	0	.12	1.44	0	11.40

The optimum program based on the initial budget is shown in Table III. Daily budget allocations used in this solution were based on estimated total raw product receipts of 12 million pounds. The daily net

TABLE 3. DAILY PRODUCTION PROGRAM OBTAINED FROM INITIAL SOLUTION

Product	Net Revenue Per Unit	Units Produced	Total Revenue
	(dollars)		*(dollars)*
Sour cherries			
No. 303 water pack	6.15	1452	8,929.80
No. 2 heavy syrup	8.53	245	2,098.85
No. 2 water pack	4.60	391	1,798.60
No. 10 heavy syrup	8.10	245	1,984.50
No. 10 water pack	3.89	3044	11,841.16
30# frozen tins	3.42	6	20.52
20 oz. frozen	6.26	1226	7,674.76
No. 303 frozen	6.84	245	1,675.80
Sweet cherries			
30# frozen, pitted	9.48	119	1,128.12
Total			37,143.11

revenue from this program exceeds that which would have been obtained from the same quantity of cherries produced according to the actual program in 1955 by $6,330. For the complete operating year net revenue would have increased from $369,767 to $445,727, or by about 20 per cent.

Program Adjustments

Adjustments in the initial program may be desirable for a number of reasons. Management may wish to evaluate the program adjustments which would result from a change in market policy or a change in the level of availability of a restricting resource. Of particular interest to many cherry processors is the kind of adjustment required in years when raw product receipts are large and regular plant storage is inadequate. This problem can be handled in one of three ways. Products can be sold during the processing season, plant space not normally used for common storage can be temporarily so used, or additional freezer capacity can be rented. Because of the wide variety of specific changes which are possible, only one of these adjustments will be illustrated here—the results of freezer rental. The method used to incorporate a selling activity is identical to that used in adding a rental activity, and the method of programming the use of temporary storage is identical with that used to program adjustments in market levels as shown below.

Since it is well covered elsewhere the details of a standard solution to a linear programming problem will not be developed here. It is necessary only to recall that with slack variables included, a production problem of the type being considered requires a solution of the mathematical problem which can be stated as:

$$\text{Max. } f(x) = c'x \text{ subject to}$$
$$Px = b \text{ and } x \geq 0$$

Where x is a column vector of activity levels, c' is row vector of net returns at the unit level of production, P is an m by n matrix of input coefficients at unit level, and b is a column vector of resource restrictions.[5] In each problem that has a solution there is an m by m submatrix $\bar{P}$ such that $\bar{P}^{-1}$ provides a basis in terms of which all other columns $\mathring{P}$ of the

[5] In more complete development of the matrix form, the initial equation $Px = b$ can be written $\overline{Px} + \mathring{P}\mathring{x} = b$ whose solution is stated $\bar{x} = \bar{P}^{-1}b - \bar{P}^{-1}\mathring{P}\mathring{x}$ where $\bar{x}$ states the level at which each process and disposal vector is included in the program, and $\mathring{x}$ represents those process and disposal vectors which are not included in the program. This notation is similar to that used by Hildreth in his discussion of "Some Problems and Possibilities in Farm Programming" and can be found more fully developed there. This notation is also consistent with that used in Charnes, A., Cooper, W. W. and Henderson, A. in *An Introduction to Linear Programming*, John Wiley and Sons, 1953.

coefficient matrix p can be expressed. Since the submatrix $\overset{\circ}{P}$ consisting of column vectors n-m is specified at all stages of solution by the multiplication $\overline{P}^{-1}\,\overset{\circ}{P}$, to add an additional activity $\overset{\circ}{p}_j$ it is necessary only to prepare a budget of the input coefficients and the net price at unit level, complete the multiplication $\overline{P}^{-1}$, $\overset{\circ}{p}_j$, insert these values into the problem and calculate for $\overset{\circ}{p}_j$ the coefficient used to select incoming activities (Δ_j in Table 4). Thereafter the solution procedes as before. If the value of Δ_j indicates that the new activity should be brought into the program one or more additional reductions will be required. New activities can be inserted at any stage of solution and any number from 1 to m additional activities can be included in the solution.

Adding a rental activity for frozen storage to permit increasing the quantity of raw product handled, resulted in an increase in the level of activity 13, the production of 30 pound frozen tins, from six units to 1,012 units. Net revenue increased from \$37,144.11 to \$39,611.77. The amount of freezer capacity which could be rented is limited by the amount of capital available. In order to further extend rental activities it would be necessary to increase the quantity of capital available to finance inventory accumulation and to pay rental charges by inserting an activity to borrow money. This and other variations could be useful in practical operating contexts, but will not be explored here.

Market Programming

An alternative means of increasing the range of obtainable solutions can be developed by changing the level of a specific restriction following the solution of the initial problem. The usefulness of this kind of adjustment can best be illustrated by programming continuous changes in the level of a market restriction. Similar continuous adjustments can be made in any restriction placed in the initial problem.[6] Basic computational procedure in making these adjustments remains unchanged; the method of selecting the outgoing row vector, and the incoming column vector, and the method of determining the level to which the restriction can be increased or decreased before a program adjustment or a change in the basis is necessary are, however, unique. The procedure for making these selections is as follows:

[6] For examples of cases where similar types of adjustments have been applied to farm situations see: Freund, R. J. and King, R. A., *The Selection of Optimal Farm Enterprises* (mimeo.), Journal Paper no. 522 of the North Carolina Agricultural Experiment Station, Raleigh, N.C., 1953; Bishop, C. E., "Programming Farm-Nonfarm Allocation of Farm Family Resources," *Journal of Farm Economics,* Vol. 38, No. 2, May 1956, pp. 396-407; Candler, W., "A Modified Simplex Solution for Linear Programming With Variable Capital Restrictions," *Journal of Farm Economics,* Vol. 38, No. 4, Nov. 1956, pp. 940-955.

1. Select the restriction (k) to be adjusted and calculate the ratios $x/\bar{p}_{ik}$ using only those elements of $\bar{p}_{ik}$ which are negative if the restriction is to be increased and only those which are positive if the restriction is to be decreased. The minimum ratio obtained indicates the maximum amount by which the restrictions can be changed without adjusting the program. This ratio also acts as the selector of the outgoing row for the reduction necessary before further adjustment can be made in the restriction being varied.[7]
2. Calculate the ratios of the negative coefficients (p_{ij}) of the selected outgoing row I to the column index (Δ_j). Select as the incoming activity that column vector for which this ratio is a maximum in absolute value.[8]

TABLE 4. ILLUSTRATIVE DATA FOR RESOURCE PROGRAMMING

Activity number	Activity no.			1	2	3	4	5	6	7	8	9	$x_i/\bar{p}_{ik}$
	b_i**	c_i	x_i \ c_j	4.203	8.113	4.693	3.424	6.255	8.096	0	0	0	
4	2000 (7)	3.424	6 (4)	−1.374	−1.372	−1.199	1	0	0	.056	.250	.458	13
5	18 (8)	6.255	1226 (5)	1.294	1.292	1.129	0	1	0	−.241	−.235	−.432	—
6	767 (9)	8.096	245 (6)	0	0	0	0	0	1	0	0	.319	768
Δ_j*				−5.52	−1.45	−3.79	0	0	0	−.030	−.106	−.183	—
d_j				.249	.946	.316	—	—	—	—	—	—	—

* $\Delta_j = c_j - \Sigma c_i p_{ij}$.
** Subscripts designate restriction numbers in the b_i column and the process or activity number in the x_i column.

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[7] Since one of the conditions of the initial problem statement is $x_i \geqq 0$ for all i a new basis will be required for any change α in b_i beyond the point where $b_i+\alpha$ results in an $x_i=0$. Recalling that $x_i=\sum_1^m \bar{p}_{ij}b_i$, for any x the new value $x_i^*=\sum_1^m \bar{p}_{ij}(b_i+\alpha)$. And the difference $x_i - x_i^*$ or ΔX_i for any i is determined by the multiplication $\bar{p}_{ik}\alpha$ where k denoted the column of $\bar{P}$ corresponding to the row which includes α. Where the quantity $^{\Delta}x$ being sought is the value which results in $x_i^*=0$ (e.g. $|x_i| = |^{\Delta}x|$) and where $^{\Delta}x=\bar{p}_{ik}\alpha$ the minimum value obtained from the ratios $x/\bar{p}_{ik}$ is the maximum value which α can take without violating the condition $x_i \leqq 0$. It is necessary to use the minimum of the ratios $x/\bar{p}_{ik}$ which are negative if b_i is to be increased and minimum of those which are positive if b_i is to be decreased.

[8] The basis for using the maximum ratio $-p_{ij}/\Delta_j$ for the selected row i to determine the incoming column can be visualized in logical terms, where it is assumed that a program adjustment is desired which will result in a minimum change in the basic matrix and where changes in the incremental returns to the restricting factor will be as small as possible. The general formula ($c^* = c - bd/a$) for calculating the new value (c^*) of any element in the complete augmented matrix of the problem uses the selected $-a_{ij}$ as its denominator. Further, since all elements of the Δ^*_j row are calculated using in addition the selected Δ_j in the numerator, the combined effect of minimizing the change in the basis matrix and minimizing the change in total net revenue with further adjustment in a restriction will be attained where the selected column coefficient becomes the maximum ratio $-p_{ij}/\Delta_j$.

I am indebted to Professor Dean McKee for valuable assistance in developing this part of the analytical procedure.

An example will help to clarify the method stated under these two points. Table 4 includes sample elements of the problem initially solved to obtain the production program shown in Table 3. Assume that it is desired to decrease the level of restriction number 9 which is shown as 767 in the b_i column. The amount of change possible before any x_i becomes zero is determined by the value of the ratios as shown in the extreme right-hand column. Since the restriction is to be decreased, only the ratios of the x_i's to the corresponding positive $\bar{p}_{ik}$ (k=9) are relevant. The least of these ratios is $x_4/\bar{p}_{49}$ or 6/.458. This ratio shows that restriction 9 can be decreased by 13 units to 754 before a change in the basis is necessary. Also when the change in basis is made row 4 will be the outgoing row for the next reduction. The incoming column is selected from the decision row d_j whose values are the ratios of the negative elements in row 4 divided by the corresponding elements in the Δ_j row. Since the element d_2 (−1.372/−1.45) is the larger of these ratios the incoming column is number 2.

The pivot point (p_{42}) is thus obtained and the adjustment of the basis proceeds as in normal solution. The incoming activity will be introduced at zero level. A positive level will be obtained when the x_i vector is adjusted to include the succeeding adjustment in the restriction being changed.

Program adjustments will be necessary as any b_i is increased, up to the point where the marginal return to the b_i being changed is zero. At this point the slack vector corresponding to this restriction will re-enter the program. Thereafter the restriction can be expanded indefinitely without further program adjustment, but for no reason since additional quantities will only increase the amount of slack or unused capacity. In contracting the level of a restriction the terminal point is reached when the resource or market level is zero. The marginal return at this point theoretically increases to infinity.

The budget for the plant used in this study was established with market capacities on 10 items (Table 1). Only three of these, No. 2 heavy syrup, No. 10 heavy syrup, and 303 frozen become restrictive in the initial solution. At the daily production level 767.8 cases (the initial market restriction) the incremental return for each case of No. 10 heavy syrup is approximately 18 cents. The level of this market was programmed downward to zero and upward until excess capacity was obtained. The results on total returns, changes in marginal returns and adjustments in other activities are shown in Table 5 and Figure 1.

The major output changes which occurred in expanding the market level are: (1) production of No. 10 heavy syrup pack increased, (2) production of No. 10 water pack decreased, (3) the production of 30 pound

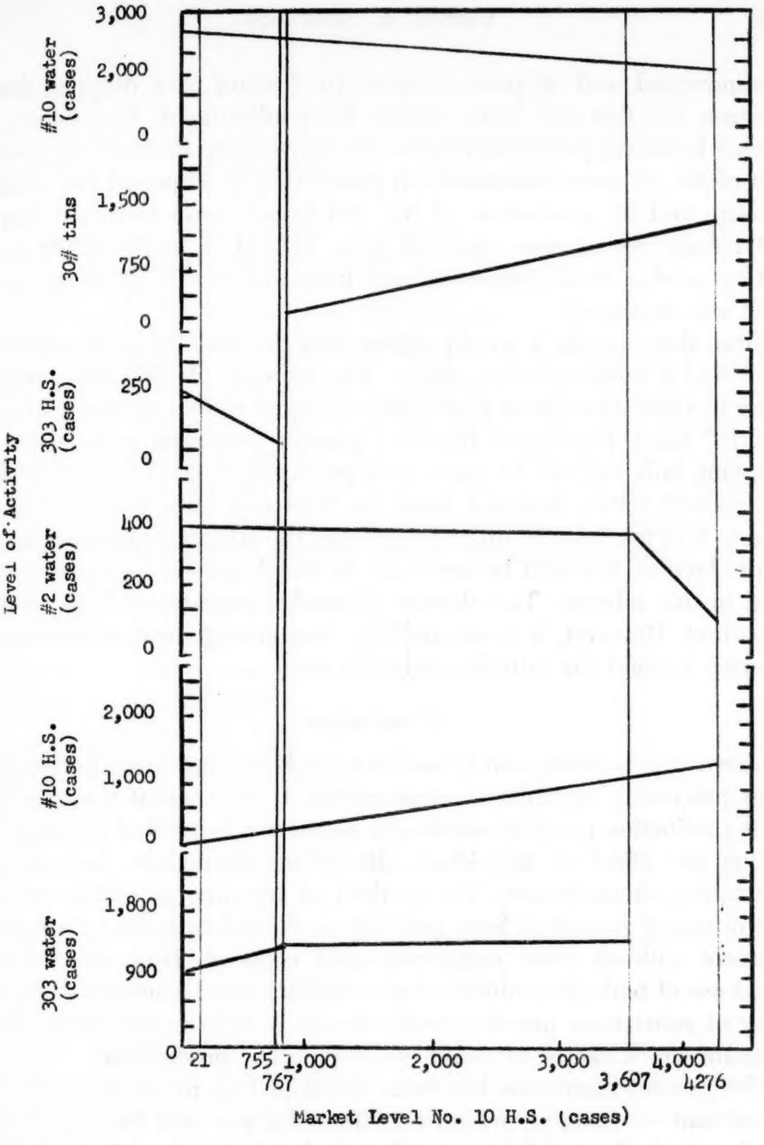

FIG. 1. PROGRAM CHANGES DUE TO ADJUSTING THE LEVEL OF MARKET RESTRICTION ON NO. 10 SYRUP PACK

TABLE 5. ADJUSTMENTS IN OUTPUT OF NO. 10 HEAVY SYRUP, TOTAL PLANT REVENUE AND INCREMENTAL RETURN DUE TO CHANGE IN MARKET RESTRICTION

Market level—cases produced	Total plant revenue (dollars)	Marginal revenue per case No. 10 heavy syrup (dollars)
0	36,629.64	
21.6	36,653.56	1.09
755.6	37,142.29	.66
767.8	37,144.52	.18
3606.7	37,664.19	.18
4276.2	37,750.68	.13

tins increased, and (4) production of No. 2 water pack dropped sharply between the first and third market level adjustment. In reducing the market level: (1) production of No. 10 heavy syrup declined, (2) production of No. 10 water increased, (3) production of 30 pound tins declined to zero, and (4) production of No. 303 heavy syrup increased sharply. Total daily net revenue declined from $37,144.11 to $36,629.64 in adjusting market level downward and increased to $37,750.68 as market level was increased.

From these results it would appear that the initially projected market level was a relatively wise choice. The increase of 3500 cases resulted in an increase in revenue approximately equal to that obtained from the first 767 cases. Further, of the total quantity produced under the initial program, only the last 12 cases were produced beyond the point where incremental return dropped from the relatively high level of $.66 per case to $.18 per case. In order to evaluate the correct adjustment in level of production, it would be necessary to weigh certain factors not measured in this solution. The element of market uncertainty is particularly important. However, it seems unlikely that management would want to produce beyond the initially budgeted level.

Conclusion

Linear programming can be useful in analyzing operating programs for firms processing agricultural commodities. It will permit working out a basic production program which can be used as a point of departure for testing the effect of individual adjustments needed to meet possible alternative circumstances. The method of resource or restriction-level-programming presented here generally is limited to testing a single adjustment with all other restrictions held constant. However, the combined use of both the addition of new activities and continuous programming of restrictions permit a wide variety of adjustments in the initial program which can be of direct use in planning production.

The present discussion has been developed in terms of short range adjustment to changing market conditions for raw and finished product. Similar methods could, however, be used to trace the effect of adjustments with longer term implications. With proper program design and with adequate data, decisions with long term implications such as expansion of plant production facilities, increasing the available quantity of permanent storage, increasing the range of market activity, etc. can be evaluated. These aids should be equally as important in the decision processes of market firm managers as the short term problems analyzed here.

ECONOMIES OF SIZE IN THE CATTLE-FEEDING INDUSTRY OF CALIFORNIA

JOHN A. HOPKIN
Bank of America N.T.&S.A.

Nature of the Industry

DURING 1956 an estimated 1,291,000 head of cattle were finished in California feed lots, most of them in very large establishments. Of the 496,000 head in feed yards January 1, 1957, 92.7 per cent were in lots whose capacity exceeded 1,000, with some yards feeding in excess of 50,000 head during the year. Only 0.3 per cent were listed for small farm-feed lots handling 100 head or less. Table 1 shows the numerical and percentage distribution of the feed lots and cattle on feed in the state by size of lot.

TABLE 1. CATTLE ON FEED BY SIZE OF FEED LOT, JANUARY 1957[1]

Size of Lot	Feed Lots		Feed-Lot Capacity		Cattle on Feed	
(No. of head)	Number of Lots	% of Total	Thousands of Cattle	% of Total	Thousands of Cattle	% of Total
100 and less	93	17.4	7.5	0.8	1.4	0.3
101–500	183	34.2	56.8	6.1	18.4	3.7
501–999	56	10.5	39.4	4.3	16.2	3.3
1,000 and over	203	37.9	820.8	88.8	460.0	92.7
	535	100.0	924.5	100.0	496.0	100.0

Not only do the feed lots vary greatly in size, but there is also considerable variation with respect to the relationship of the feed-yard operation to the other phases of agriculture on the farm or in the community. At the one extreme is the farm feeder whose cattle-feeding enterprise is complementary with his other farming enterprises. Most of the feed is raised on the farm, and much of the labor is frequently furnished by the farm family. Here the feeding program dovetails neatly with the cropping program. At the other extreme is the large commercial feed-yard operator who purchases all his feed and hires all his labor, but owns no cattle; rather, he feeds cattle for other people on a custom basis. In between these two extremes is the owner feeder whose feeding operation tends to be vertically integrated with cattle ranching operations, a crop-processing plant, or a meat-packing plant. He feeds his own cattle, but purchases all

[1] *Quarterly Report of Cattle on Feed.* California Crop and Livestock Reporting Service, Sacramento, California, January, 1957.

or most of the feed. In reality there are no clear-cut lines of demarcation between these three types, and classification of some yards is rather arbitrary as a result. An important combination among these types is the owner feeder who also does considerable custom feeding.

No precise figures are available on the number of cattle being fed in the different types of feed lots at the present time. During the 1952-1953 feeding year, 57 per cent of the cattle going through feed lots in California were custom fed.[2] Probably not over 10 per cent were fed in farm feed lots as the term is used above. The remaining 33 per cent were fed by owner feeders, although about half of these cattle were owned by operators of commercial yards.

Theoretical Considerations

Economies of size in the cattle-feeding industry of the Southwest include both economies of intensive use of plant and economies of scale as described by Viner, J. M. Clark, Boulding, *et al.* Important labor economies occur when the feed yard becomes sufficiently large that labor specialization is possible—when one man can spend all of his time mixing rations, for instance, while another man spends full time "working" the cattle. When numbers of cattle fed are increased sufficiently, new skills, such as those of a veterinarian, an animal nutritionist, or a marketing specialist, can be made available on a full-time basis, as is done in a few cases in the state. In recent years, cattle feeding in California has become an industry with high fixed costs which generate a heavy per-unit cost burden when not spread over large numbers of cattle.

Still another important economy of scale (and one which we could not investigate in this study) arises from the increased bargaining power of the firm as the number of cattle fed is increased. This increased bargaining power might occur in buying feeds and livestock, or it might appear in selling the fat cattle at an advantage by attracting frequent visits from a large number of cattle buyers. Several managers of the larger commercial firms indicated that many of their customers—other than chain stores or packers—depend on the manager to decide when the customer's cattle should be sold. In some cases the manager also purchases the feeder cattle for the customer. A reputation for being skillful in buying and selling cattle might be equally as important in attracting customers with cattle to be fed as a reputation for being able to obtain economical weight gains. While bigness is not essential to the acquisition of such skills, the larger firms appear to have an advantage in establishing this kind of reputation.

[2]Scott, F. S., Jr. "Marketing Aspects of Western Cattle—Finishing Operations," Western Regional Research Publication No. 190. University of Nevada, December 1955, p. 48.

In the analysis of economies of size which follows, Viner's conceptual model of scale economies is used, since the distinction between long-run and short-run (nonscale) adjustments is shown neatly in his model of long-run and short-run cost curves. In the short run, the physical plant (capacity) is fixed, while other inputs are variable. That is, in the short run, feed-yard capacity does not change, but the number of cattle fed annually can be increased by feeding more lots of cattle in the same yard. Since all figures were calculated on the basis of a 120-day feeding period, a maximum of three lots of cattle per yard could be finished in one full year. The maximum possible feeding ratio,[3] then, is 3.00. The minimum possible feeding ratio is zero, which would obtain if no cattle were fed during the year. For this study, *short-run economies are defined as economies resulting from shifts in the feeding ratio*—the physical plant remaining fixed.

Short-run economies should be distinguished from shifts in scale in which the proportions of various important inputs are held constant. With "short-run" changes, the number of cattle and the quantity of feed are altered while most other inputs remain constant. This distinction between short-run adjustments in the feeding ratio and the long-run adjustments of plant capacity is a very meaningful one to cattle feeders.

In the *long run*, the physical plant itself is assumed to be flexible—i.e., the feed-yard *capacity* can be changed. New land can be obtained, new feed mills and feeding equipment purchased, new pens erected, or new feeding techniques adopted. *Long-run economies of size are defined as those associated with changes in plant capacity.*

In the absence of data showing changes in costs and sizes of given feed yards over time, short- and long-run economies are here approximated by analyzing a cross section of the industry at one point in time. Throughout the following analysis, therefore, runs the implicit assumption that cross-sectional relationships of costs and sizes are valid reflections of the relationships that could be observed if a typical feed lot were altered in size.

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[3] The feeding ratio is the ratio of total numbers fed to feed-yard capacity. In calculating this ratio for the study, the number of head fed was adjusted to a 120-day feeding period. Since every operator appeared to have a definite impression regarding the "capacity" of his yard—the maximum number of cattle which he could "satisfactorily" manage in his yard at one time—the reported capacity was used as the denominator of the ratio. This definition of capacity, which is conventionally used by animal husbandmen, is based on rules of thumb relating primarily to physical phenomena. It ignores the problem of determing economic capacity, which is a function of both the added per-unit costs and the added per-unit returns associated with increasing the number of cattle fed in a given yard over a specified period of time. In an economic sense, capacity varies as the price level of inputs or outputs varies. As used in this study to determine the feeding ratio, however, it is a relatively fixed number for each yard.

In studying long-run economies in this manner, it would be desirable to observe firms of different capacities which were otherwise proportional in every respect, including management. Differences in their costs could then be attributed to differences in scale. Actually, different firms usually are not similar in other respects, so that the scale effects tend to be confounded with the influence of other forces. To the extent that these effects result from random factors, they tend to cancel one another when the costs of several firms of similar size are averaged together and compared with the averages of other size groups.

Where these factors are not random but tend to be directly associated with size, however, their influence is confounded with the effects of scale. The most striking example of this is the influence of changing technology, which in general is positively related to size. One of the primary advantages of increasing the size of a feed yard is that it frequently permits the adoption of new technologies with capital requirements which were not economical at lower levels of production.

Nevertheless, from a pragmatic point of view, the cattle-feeding industry is less interested in knowing the economies of "pure" scale—in the classical sense—than in knowing the differences in costs associated with changes in plant capacity where these costs reflect the impact of new technologies currently available with increased volume of business. Since this study is directed toward the latter problem, the analysis of long-run changes is couched in terms of size rather than scale.

The Industry Sample

Information bearing on the problem of economies of size in California cattle-feeding operations was obtained in personal visits to a sample of feed yards scattered over most of the state. No stratification was made by type of feed-lot organization—farm feeder, owner feeder, commercial feeder, or combined owner and commercial feeder—since this classification was undetermined until the interview was made. Nor could stratification be made by size of feed lot, since this information was not available to private business organizations. There was, however, a good distribution of both small and large feeders with various types of feed-lot organization. Although the farm feeders in the sample were smaller than the owner feeders and commercial feeders, on an average, there were a number of the former who finished in excess of 3,500 head. Furthermore, several in both the commercial-feeder and owner-feeder class finished fewer than 2,000 head.

Within each geographic subdivision of the state an attempt was made to enumerate the entire population of cattle feeders from information supplied by county farm advisers, Bank of America district appraisers, and

leading cattle feeders in the area. The inventory was quite complete for all areas except the Southern California (less Imperial Valley) and the North Coast and Mountain districts. Information for the latter district was somewhat limited. However, only 0.9 per cent of the cattle on feed January 1, 1957, were located in this area. From this list of cattle feeders, the sample was random within each area stratum.

Information concerning investments, volume of business, costs and animal gains, as well as feeding and marketing practices was obtained from a sample of 85 feed-yard operators. Of this total number of records obtained, 77 were considered applicable to and adequate for this study.[4] Based on these data, substantial variation was found in the nonfeed costs of cattle finishing among the sampled feed yards. When grouped according to kind of operation—farm feeder, owner feeder, commercial feeder, or combined owner and commercial feeder—differences in the daily nonfeed costs among the four groups were found to be insignificant when firms of comparable size were compared. Likewise, differences in daily nonfeed costs per head with different types of feeding—dry-lot or soiling—were not statistically significant. Costs did, however, vary significantly with differences in the ratio of numbers fed per year to feed-yard capacity. Nonfeed costs also were found to vary significantly with differences in size as measured by feed-lot capacity.

The Analysis

To provide a basis for estimating economies of size for feed-lot operations in California, the records of the 77 sampled feed lots were divided into six groups on the basis of reported feed-yard capacity. The nonfeed costs were computed for each firm; in addition, the average investment and cost figures for each of the six groups were computed (see Appendix for a discussion of the assumption and procedure by which costs were calculated) and then used in constructing the six "working models" depicted diagrammatically by the short-run cost curves[5] of Figure 1. For each of the six groups the average characteristics of all firms in the group were used as if they were the actual record of a single firm of specified capacity. These six average-cost positions are represented by the points $A_1, A_2, \ldots, A_6$ in Figure 1. Line $L_1 L_1'$ was drawn by inspection to show the approximate relationship among the average costs of the six models.

[4] A more complete analysis of the cost structure of the cattle-feeding industry, based on these records, is reported in *Cattle Feeding in California*. Economics Department, Bank of America N.T.&S.A., San Francisco, California, February, 1957.

[5] The cost curves under discussion in this paper refer to nonfeed costs only. Total cost curves would have the same slope (the same absolute change) as their corresponding nonfeed cost curves, although the former would have much less proportional change than the latter.

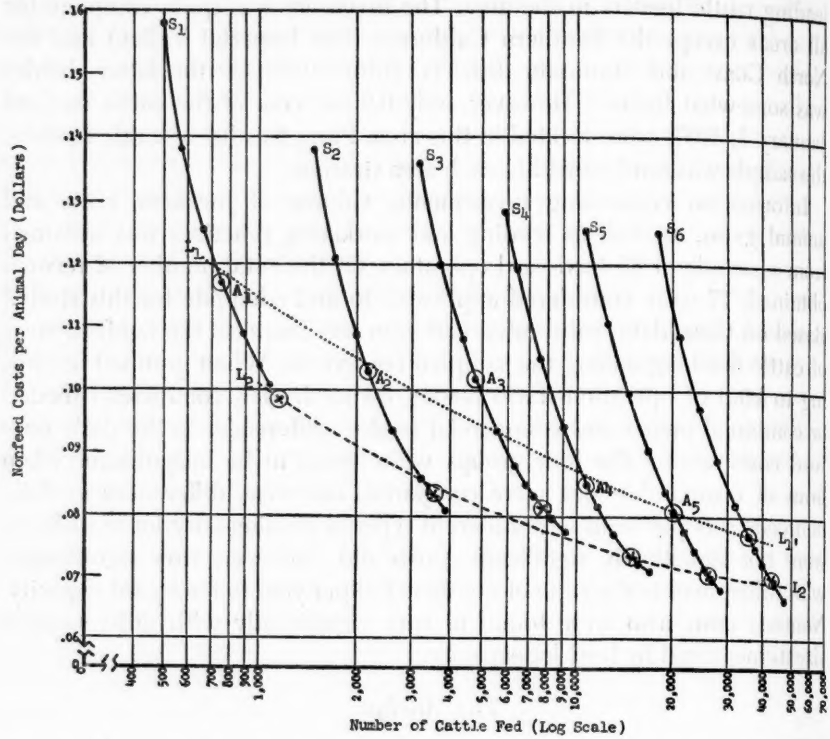

FIG. 1. AVERAGE SHORT-RUN AND LONG-RUN RELATIONSHIPS BETWEEN NUMBER OF CATTLE FED AND DAILY NONFEED COSTS PER HEAD.

The short-run cost curves for these models are illustrated in Figure 1 by the six solid lines labeled $S_1, S_2, \ldots, S_6$. They are estimated by varying the feeding ratio (increasing or decreasing the average number of head fed per year), using the budgeting technique.

The following assumptions were made in calculating the short-run cost curves, beginning with the average position for each model. Total investment in physical plant was assumed fixed; thus total costs per yard for interest, depreciation and repair, taxes and insurance remained constant regardless of numbers fed.

One half of total labor costs were considered to be fixed, the remaining half varying directly with numbers fed. This assumption appears to fit quite well the observed differences in labor costs among firms of about equal capacity but with different feeding ratios. Because it implies a constant relationship between numbers fed and variable labor costs, the assumption obviously does not hold true at the extremes. However, as a procedure for adjusting labor costs for moderate shifts in the feeding ratio

from some medium position, this assumption appears reasonably precise.

Total power and fuel costs per yard were assumed to vary directly with numbers fed. Death loss and veterinary and medical expenses were assumed to be an increasing function of numbers fed, increasing 2.0 per cent (not compounded) per head for every .10 increase in the feeding ratio. Overhead and administrative costs were assumed to be one-fourth fixed and three-fourths variable. These assumptions fit very closely the observed variations in physical inputs and costs among the sampled feed yards.

Undoubtedly it would make some difference to such costs as labor, power and administration whether a feeding ratio of 2.00 (for instance) were obtained (1) by filling the yard to capacity twice during the year (each lot being fed for 120 days) and then closing the yard for the remaining four months, or (2) by feeding three separate lots of cattle during the year, with each lot equal to two-thirds of yard capacity. Some of these differences, however, would be offsetting. To simplify the calculations greatly, the assumption regarding the time sequence in which the cattle were fed was made to coincide with situation (2) above. That is, numbers of cattle on feed were assumed to be kept approximately constant throughout the year. Errors in the cost figures introduced by this simplifying assumption are negligible, except, perhaps, at the upper portion of each short-run cost curve. These errors probably tend to make the slope of the upper portion of each curve slightly steeper than the real situation would indicate. However, as one moves down the short-run cost curves (as the feeding ratio is increased) the influence of any biases introduced by this assumption decreases, reaching an influence of near zero at the lower portion of the plotted line. Furthermore, it is the lower portion of the cost curve that has the greatest practical meaning to the industry.

Each curve was cut off at an arbitrary lower limit to the feeding ratio (upper limit to costs) of 1.00—where the lot is maintained at one-third of capacity throughout the year. This is equivalent to having fed only one capacity lot of cattle for a 120-day period during the entire year. Similarly, each curve was cut off at an arbitrary upper limit to the feeding ratio (lower limit to costs) at the average ratio of the three firms within each group whose feeding ratios were the highest. Although these latter points obviously were somewhat arbitrarily selected, they do provide an obtainable goal for other firms within each size group. The feeding ratios at the lower limit of costs varied from 2.20 for group I to 2.62 for group VI.

Under our assumption of a 120-day feeding period, the absolute maximum feeding ratio physically attainable would be 3.00, which would allow practically no time between lots of cattle. As soon as one pen of cattle was sold, the pen would have to be filled immediately with incoming feeders. Furthermore, each pen would have to be filled to capacity

throughout the entire year. For reasons of sanitation, some time should be allowed between lots of cattle for cleaning and drying the pens. And yard maintenance can be accomplished most efficiently when some of the pens are empty of cattle. Failure to provide for any time between lots of cattle means risking higher death loss, inefficient gains, and costly handling of cattle. Only three of the 77 records used in this study showed a feeding ratio in excess of 2.80.

As the average feeding ratio is increased beyond the computed limits, one should expect to reach a point at which daily gains and the market grade of the finished animal begin to drop. This would cause costs per "unit" of output to increase and would appear diagrammatically as the conventional U-shaped cost curve. However, this study provided no basis for making specific assumptions about differences in quantity and quality of daily gains associated with very high feeding ratios. The upper limits on feeding ratios used in this study appear to be reasonably attainable goals for those firms desirous of lowering their nonfeed costs.

Whether or not it would pay an individual operator to lower his costs beyond these limits by increasing his feeding ratio depends on a number of physical factors which would influence gains—such as climate, drainage and shelter, and skill with livestock—as well as on such economic factors as prices of feeders, feeds and finished beef. Each operator must constantly appraise such matters for his own situation. There is little question, however, that most operators could materially lower their costs by increasing their feeding ratios up to about 2.50-2.60 inasmuch as gains appear not to be adversely affected up to that point.

The reasonableness and applicability of the assumptions used in this analysis and synthesis are demonstrated in Figure 2 where the scatter of individual firms used in the study are plotted with (1) the actual nonfeed costs per animal day on the vertical axis, (2) the actual feeding ratios on the horizontal axis, and (3) each firm identified as to its own size group by special markings. This technique places all firms within each size group on a comparable basis, and arranges the firms within each size group so that the relationship between the feeding ratio and nonfeed costs is reflected. The synthesized short-run cost curves of Figure 1 have been superimposed on this scatter. The pattern of the scatter for each size group fits quite closely the synthesized short-run cost curve for that group. In general, the precision of the fit improves materially as the average size of the firms increases, owing to the greater homogeneity among the larger firms as well as to the fact that the larger firms tended to supply more reliable data than did the small firms.

As a further check on the validity of the assumptions back of the synthesized models, the several short-run cost curves were determined mathe-

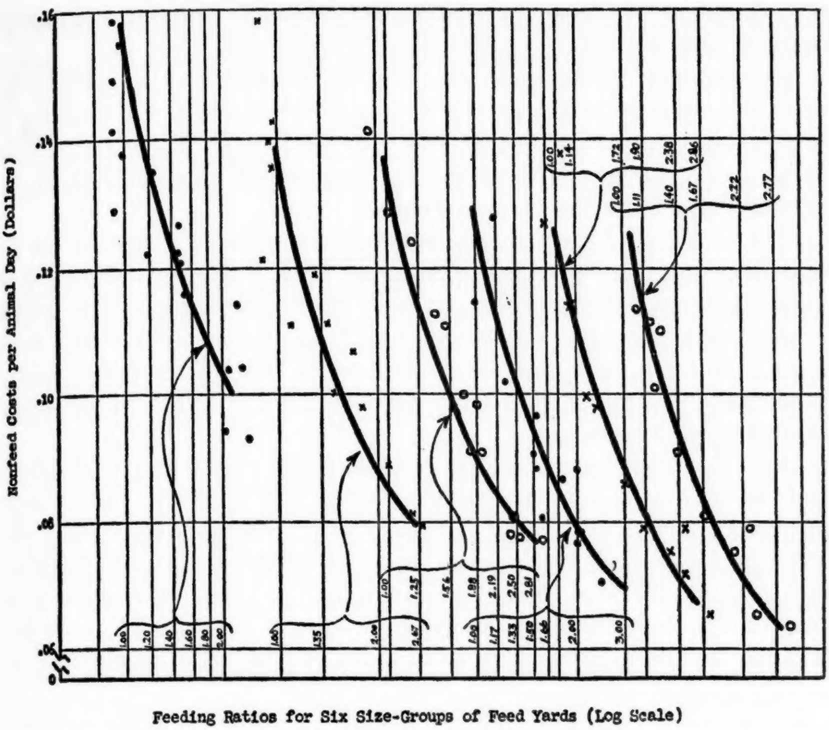

FIG. 2. RELATIONSHIP BETWEEN SIZE OF FEEDING RATIO AND NONFEED COSTS FOR FEED YARDS OF VARIOUS SIZES.

matically from the respective sets of data shown in Figure 2.[6] The equations define curves which are almost identical (within the ranges of the feeding ratios shown in Figure 2) to the short-run costs curves shown in Figure 1 and 2. Certainly the synthesis is consistent with these empirical findings and, in addition, provide detailed information concerning the typical patterns by which the component cost elements vary—information

[6] The method of least squares, employing the quadratic formula $Y = a + bX + cX^2$ was used to compute the short-run cost curves. The several equations, their respective standard errors of estimate and correlation coefficients are listed below.

Size Group	Equation	Sy.	r
1	$Y = 21.53 - 8.93X + 1.70X^2$	.765	.922*
2	$Y = 22.82 - 11.62X + 2.29X^2$	.772	.943*
3	$Y = 21.91 - 10.23X + 1.85X^2$	.378	.975*
4	$Y = 17.80 - 7.08X + 1.13X^2$	.986	.852*
5	$Y = 19.24 - 8.97X + 1.63X^2$	.487	.660**
6	$Y = 18.58 - 8.24X + 1.40X^2$	.552	.956*

* Significant at 99 per cent level of confidence.
** Significant at 97 per cent level of confidence.

that should be of interest to individual operators in planning and managing their own feed lot.

The steepness of the slopes of the short-run cost curves explains why many operators seem to be as much or more concerned about operating at high volume as with costs of feeds or prices of feeding. Furthermore, such behavior on the part of the operators gives added substantiation to the general shape of the short-run cost curves.

Line $L_2\ L_2'$ of Figure 1 approximately connects all points on the six short-run cost curves which correspond with a feeding ratio of 2.40 (approximately the average upper limit to the feeding ratio for the six groups), thus providing an indication of the long-run economies of scale for the industry. This line shows that cattle feeding as predominantly practiced in California is a decreasing-cost industry within the size range of its present organization.

This conclusion appears to be in general harmony with the stated intentions of the feed-lot operators included in this study. The average planned expansion in feed-lot facilities for the following year (1956) was 413 head for group I, 905 head for group II, 1,085 for group III, 1,094 for group IV, 958 for group V and 433 for group VI. Most of the operators of group I, the majority of the operators of groups II, III and IV, and less than half of the operators of groups II and VI planned to expand feed-lot capacity the following year.

The expansion plans of group I seemed to follow no definite pattern and to be less definite than those of the other groups. Many of those in groups II-VI, not planning to expand the following year, faced some specific bottleneck peculiar to their own situation which, they felt, kept them from expanding. A few operators within groups IV, V and VI felt they were as large as they wanted to be, and had no present plans for any future expansion at any time. Among those planning to expand, very few operators in any group seemed to have a definite idea regarding the ultimate size of their firm. In general, plans for expansion were indefinite for periods beyond one year.

There are several implications of this conclusion. First, it means that the upper limit on the size of feed yards likely has not yet been reached in California. The larger firms are likely to grow even larger in the years ahead, and in so doing should become even more efficient. It is not yet possible to say how large these firms might grow without reducing their efficiency, although there are strong indications from this study that costs of administration are a diseconomy of size. These figures indicate that administrative costs might soon rise so rapidly as to more than offset economies of size, unless important administrative changes were made. We should expect to see the average size of feed lots shift upward as new firms are established and as existing firms continue to expand in size.

Private individuals and firms as well as public institutions and agencies which service the cattle-feeding industry could contribute to the efficiency of the industry (and consequently toward lower cost of beef for consumers) by adopting policies and programs which would help each feed-lot operator (1) keep his yard operating at a high feeding ratio in the short run, and (2) increase the size of his operation to take advantage of the long-run economies that result.

Two of the assumptions back of this analysis are questionable when applied to the farm feeder. First, the value of the operator's labor (and the value of family labor, where applicable) was charged at $1.50 per hour. For the farm feeder, however, the alternative use of this labor is frequently very limited; indeed, one of the important reasons he is feeding is to provide better labor utilization. Furthermore, during seasons when there are alternative uses of labor, the opportunity cost of that labor to the farm feeder frequently is higher than $1.50 per hour. Second, the cattle-feeding enterprise was analyzed as a single and separate business. On some farms, however, cattle feeding is an integral part of the farming program, providing a market outlet for crop by-products and other feeds which would be difficult to market otherwise, as well as providing manure needed for soil-fertility maintenance.

A farm family with a surplus of labor has a labor cost of zero against its cattle-feeding enterprise if the labor has no available alternative market. Likewise, a farmer with unmarketable crop residues useful in feeding cattle has different feed costs than does a commercial feeder who handles only marketable feeds; the cost of unmarketable crop products to the farmer is zero. These differences in the valuation of labor and certain feed inputs partly explain not only why there are a number of relatively small farmer feeders, despite existing economies of size in the industry, but also why farm feeders continue to operate in the face of falling prices when other feeders might be forced to cut back or even to liquidate because of losses.

As the farm feeding enterprise expands, the relative importance of those resources with zero opportunity costs (surplus labor and unmarketable feeds) diminishes. Likewise the enterprise relationship between feeding and crop production becomes less complementary and more competitive, so that the farmer is forced to divide his key talents between his feeding and nonfeeding operations. As his cattle enterprise expands he may well find his efforts excessively diverted to the feed lot at the expense of the proper performance of important management functions for his main enterprises. In this case, the high opportunity cost of his own labor and management tends to limit the size of his feeding enterprise. This special situation is exempt from the conclusions regarding size adjustments.

Appendix

The points of division among the six size groups of feed yards were selected by judgment based on two factors. First, consideration was given to the fact that there is greater uniformity among the larger yards than among the smaller firms. Furthermore, the records of the larger yards are kept with greater care and precision, frequently being posted by CPA's; whereas, the records from which the data for the smaller yards were taken are not nearly so complete. For these reasons, the number of firms sampled per group was decreased as feed-yard capacity of the group increased. Second, consideration was given to apparent breaks in the data wherever possible.

The average-cost figures for each of the six groups are listed in Appendix Table 1, along with the average capacity, average number fed and average investment per head fed.

The cost data for labor, fuel and power, vet and medicine, death loss, and administration and overhead were based directly on the operators' records. Depreciation and repair costs were estimated at an annual rate of 7 per cent of the investment in all feed-yard facilities. Taxes were esti-

APPENDIX TABLE 1. A COMPARISON OF AVERAGE DAILY NONFEED COSTS PER HEAD AND OTHER FACTORS BY SIZE OF YARD

Size Group	I	II	III	IV	V	VI
Range in feed-lot capacity	Below 1,200	1,200–2,499	2,500–4,999	5,000–7,999	8,000–13,999	14,000 & above
Number of feed yards per group	17	14	13	12	11	10
Average capacity	486	1,498	3,205	6,479	10,531	18,053
Average number fed	784	2,300	4,947	10,984	20,160	35,568
Average investment per head fed in feed-yard facilities	$23.53	$24.93	$23.83	$18.85	$19.62	$17.44
Average nonfeed costs per day	(cents)	(cents)	(cents)	(cents)	(cents)	(cents)
Labor (other than office)	5.79	4.08	4.20	3.81	3.52	3.30
Depreciation and repair of equipment	1.37	1.45	1.39	1.10	1.14	1.01
Taxes	.79	.83	.79	.63	.65	.58
Interest on investment	1.57	1.66	1.59	1.26	1.30	1.15
Insurance	.36	.37	.36	.28	.29	.26
Fuel and power	.56	.74	.57	.57	.45	.39
Vet and medicine	.35	.38	.30	.31	.26	.31
Death loss	1.05	.87	1.16	.99	.83	.73
Administration and overhead	.81	.80	.74	.35	.48	.84
Gross nonfeed costs	12.65	11.18	11.10	9.30	8.92	8.57
Credit for manure	.88	.88	.88	.88	.88	.88
Net nonfeed costs per day	11.77	10.30	10.22	8.42	8.04	7.69

mated at a rate of 60 mills, based on an assessed valuation equal to two-thirds of current inventory value.

The most meaningful rate of interest to use would be the opportunity cost of capital to the feed-yard owner, i.e., the return to the owner for that capital if it were employed in its most remunerative other use. For liquid capital, this opportunity cost is usually higher than the market rate of interest. The market rate, then, sets the lower limit for liquid capital but does not govern the upper limit for the rate of interest to be used in economic analysis. Any single rate of interest applied to a large number of firms at one time must be selected quite arbitrarily. For this study the annual interest rate was assumed to be 8 per cent.

There are substantial differences in insurance costs among feed yards due, primarily, to (1) a difference among operators in the amount of risks they are unwilling to carry themselves and for which they carry insurance, and (2) the fact that a few of the newer yards have been designed so as to reduce risks and, hence, insurance rates. To eliminate the influence of these two factors and thus obtain greater comparability of other costs, insurance was computed at the average rate of 1.8 per cent of investment.

The average value or selling price of manure for the sampled feed yards was $2.52 per ton (dried) in the yard. Using a conservatively estimated production of seven pounds of dried manure per head per day, the credit for manure averaged .88 cents per animal day.

The nonfeed costs per day averaged 11.77 cents per animal day for size group I, with an average capacity of 486 head. As shown in Appendix Table 1, these costs decreased consistently as the average size of the yards increased. For size group VI, with an average capacity of 18,053 head, the average daily nonfeed costs were only 7.69 cents per day.

MEMBERSHIP ATTITUDES OF THE AMERICAN FARM ECONOMIC ASSOCIATION*

Harry C. Trelogan
Agricultural Marketing Service, U.S.D.A.

HIGHLIGHTS of answers to a questionnaire distributed at the last annual meeting are briefly summarized. The questions were designed to ascertain membership attitudes toward several anticipated problems requiring consideration by your officers.

The sample. Questionnaires were distributed to attendants at the opening general session of the meeting at Lake Junaluska, North Carolina, in August 1957. Most of the returns were received at the meetings, but a few questionnaires were carried back to the colleges to be completed. A total of 392, close to two-thirds of the questionnaires distributed, were received in time to be included in the tabulation.

Over half the respondents were affiliated with universities, and just over a fourth with the federal government. The remaining fourth were scattered among industry, state government, and other affiliation. Research, and research and teaching were the major activities of respondents, followed by extension. Combinations of research, teaching, extension, and administration accounted for most of the rest. Only 1 per cent of the respondents reported they were not members of the association, with regular members outnumbering junior members 11 to 1.

Association activities. Those who filled in the ballot were asked to score a list of actual and potential activities of AFEA "very important," "somewhat important," or "not so important." The only two activities which were scored "very important" by most members were the publication of the *Journal* (97 per cent) and annual meetings (93 per cent). The group's attitude on the other items was considerably less crystallized. When asked what was the most important activity from their own standpoint, the same ranking of interests was revealed.

In intermediate favor, in descending order, were student activities and awards programs, joint meetings with allied societies, publication of bibliographies of current literature, employment service, election of Fellows, publication of roster, and affiliation with other scientific bodies.

* *Acknowledgment.* The design of the questionnaire, and the editing and coding of completed schedules were performed by personnel of the Market Surveys Section, Marketing Research Division, Agricultural Marketing Service. Card punching and machine tabulations were contributed by the Department of Agricultural Economics, Agricultural Experiment Station of Cornell University. Copies of tables are available and may be obtained for a limited time on request to Robert M. Walsh, Chief, Market Development Branch, U. S. Department of Agriculture, Washington 25, D.C.

Activities receiving least support were the fostering of local chapters and service for corresponding members. Publication of news bulletins and sponsorship of lectures and training programs also received low ratings.

Annual meetings. Agricultural policy, theory and methodology were the subjects most widely selected as being of interest for discussion at annual meetings. In the multiple-check question concerning subject areas considered for inclusion in the programs, seven in 10 of the respondents checked agricultural policy, over five in 10 checked theory and methodology, nearly five in 10 selected production economics, and a similar number chose marketing. Farm management and prices were each checked by about four in 10.

About one-fourth of the respondents indicated most interest in income and demand, land economics, consumption economics, and in foreign agriculture. About a fifth expressed most interest in agricultural statistics and in agricultural credit.

The responses indicated greater mutuality of interest among the membership in policy and theory but greater intensity of individual interest in the less general subjects. The data suggest the most acceptable balance between plenary sessions devoted to subjects of widespread interest and sectional meetings devoted to more specialized subjects. They are also indicative of the relative allotment of sectional meetings to the different subject-matter areas that would best correspond with the interest expressed.

Generally, the membership was not responsive to the question of preferences for expansion or contraction of activities at the annual conferences. With regard to general meetings, for example, 70 per cent gave no preferences, and the remaining votes were split evenly between "expand" and "contract." On the subject of sectional meetings, however, 42 per cent voted and favored expansion over contraction roughly two to one.

A related question on sectional meetings, where all but an eighth cast ballots, indicated a moderate preference for the allocation of more periods to sectional meetings and a distinct preference for having fewer sessions held simultaneously in each period.

With less than 20 per cent of the respondents voting on the following items, slight preferences were indicated for contracting time allotted to the awards program, to social activities, to free time, and to the business meetings.

Cost and revenue. Revealing information on respondents' attitudes toward the *Journal* was obtained in a series of questions on bringing Association cost and revenue in balance. To the hypothetical question, "If cost of the *Journal* were to be reduced, in what order would you favor the following steps?"—reduction in size of the Proceedings issue was ranked first for action. A close second was discontinuance of free distribution of reprints

to authors. Respondents were less favorably inclined to seek cheaper methods of reproduction or to reduce the size of the regular issues. Least favor of all was expressed for elimination of the Proceedings issue or reduction in number of regular issues.

In response to a question relating to possible reduction in size of regular issues, two-thirds favored limiting length of articles, and over 60 per cent favored eliminating the list of graduate students in agriculture. These were the most clear-cut responses, but half the respondents favored eliminating lists of publications received as well as lists of degrees conferred. Over a third favored curtailing book reviews, but less than a fourth voted for fewer articles. This was a multiple-choice check list, and it is perhaps significant that elimination of news notes and notes received only 14 and 10 per cent, respectively, of the votes.

With regard to suggestions for reduction in the size of the Proceedings issue, approximately two-thirds favored limiting length of main papers and discussants' papers. Some 40 per cent favored publication of abstracts of papers, and a third favored selection of papers by editors. But less than a fifth would delete discussants' papers or section-meeting papers or make any other changes.

On the direct question of methods for increasing revenue of the Association, the largest majority (62 per cent) favored raising annual dues, some to a maximum of $8.00 and some to a maximum of $10.00. A small percentage favored a $9.00 maximum. A majority (55 per cent) also voted for solicitation of additional funds to finance awards program and for solicitation of sustaining memberships from business firms (52 per cent).

Between 42 and 45 per cent favored increasing *Journal* subscription rates for *domestic* libraries and firms, raising registration fees for annual meetings, and for main dependence on increased membership.

Somewhat over a third would require authors to buy *Journal* reprints as part of publishing articles and would increase *Journal* subscription rates for *foreign* libraries and firms. Only 15 per cent favored "popularizing" the *Journal* so as to attract more advertising.

Abstracts of Journal articles. The question of desirability of having another interested organization publish abstracts of current agricultural literature drawn from journals throughout the world, on the whole, received a favorable response. Some 41 per cent considered it "very important," 43 per cent "somewhat important," and only 14 per cent "not so important" or "not needed."

ERRATA

The following corrections should be made in the article "Application of Queueing Theory in Determining Livestock Unloading Facilities" which appeared in the February, 1958 issue:

1. On page 109 solving the equation

$$\frac{-\lambda^2}{\mu} P_0 = -\mu P_2$$

should give

$$P_2 = \left(\frac{\lambda}{\mu}\right)^2 P_0$$

2. On page 109 the equation following "Summing These Values" should read

$$\sum_{n=0}^{\infty} P_n = P_0 \sum \left(\frac{\lambda}{\mu}\right)^n$$

3. On page 110 the solution for P_0 should read . . . since the

$$\sum_{n=0}^{\infty} P_n = 1$$

we have:

$$1 = \frac{P_0}{1 - \frac{\lambda}{\mu}} \quad \text{or} \quad P_0 = 1 - \frac{\lambda}{\mu}$$

Therefore,

$$P_2 = \left(\frac{\lambda}{\mu}\right)^2 \left(1 - \frac{\lambda}{\mu}\right)$$

or in the more general case

$$P_n = \left(\frac{\lambda}{\mu}\right)^n \left(1 - \frac{\lambda}{\mu}\right), \qquad \frac{\lambda}{\mu} < 1$$

NOTES

VERTICAL INTEGRATION AND FARM MANAGEMENT RESEARCH*

EMERY N. CASTLE
Oregon State College

THE development of vertical integration has captured the imagination of academic and nonacademic people alike. In recent months, many articles have appeared and numerous speeches have been made predicting the effect of this development on American agriculture. No one can see clearly at this time how much of American agriculture it will affect. Indeed, our statistics are inadequate on the portion of American agriculture that now operates under some form of integration. The revolution it has brought about, however, in the broiler industry cannot be dismissed lightly.

Research workers are not disregarding integration. Research projects are being proposed and initiated by many marketing people. Some view this as a completely new field; others prefer to say this is just renewed interest in the older subject of market structure. Relatively little attention, however, has been paid to its possible effect on farm management research. The purpose of this note is to make a few observations on the subject. It is not an exhaustive examination of all of the implications of integration on farm management research, nor is it an attempt to predict the future of integration; it can be argued that there are forces working toward both integration and disintegration. Rather, it is an attempt to place this development in perspective as new research is contemplated in relation to existing research projects.

Integration and Decision Making

Mueller and Collins have described vertical integration as "the coordination of decision-making processes of two or more stages of production."[1] They go on to say "there are many gradations in the degree of such coordination. The limiting case, of course, is where successive stages of production are brought under unified management through ownership either as the result of a merger of previously independent firms or through vertical expansion of one firm's activities by internal growth. Grower-processor integration usually is a less complete form of integration than that created by ownership: it covers fewer activities and decisions, is of shorter duration and permits retention of ownership identity."

If the above is accepted as an adequate description, it is obvious

* Technical Paper No. 1115, Oregon Agricultural Experiment Station.

[1] Mueller, Willard F. and Collins, Norman R., "Grower-Processor Integration in Fruit and Vegetable Marketing," Proceedings issue, *Journal of Farm Economics*, December 1957.

there are many facets to the application of integration. It is also obvious its effect on the allocation of on-the-farm resources will vary with the type of arrangement. That is, a contract with the supplier of feed, for example, will have a different effect than will a completely integrated arrangement where supplies, production, processing and retailing all come under a centralized management. The instrument used to achieve coordination, contract or outright ownership, will also have an effect. Whether the integrating firm is a cooperative or a private business must also be taken into account.

It is not possible to lay down general decision-making criteria that will apply to all these diverse situations. However, some generalizations can be made. Contracts are resorted to to accomplish three things: (1) eliminate price uncertainty, (2) establish a stable supply, and (3) insure standard quality. The more complete the integration the greater the emphasis given to producing to specifications. Contracts serve as a device for the processor or the retailer to exert control over the production processes on the farm. Top management may pass down the requirements as to quality and quantity. It will be the job of the field staff to let and supervise the appropriate number of contracts to achieve these specifications. If the integration is "tight," the interests and desires of the farmer will be taken into account much less than if the integration is "loose" and a substantial quantity of the commodity is not being produced under contract. The contract itself may be "tight" or "loose," depending upon the bargaining position of the farmer. The allocation of resources which finally results will be a compromise decision which attempts to satisfy the numerous objectives of the parties to the contract.

If a cooperative becomes the integrating firm, interesting possibilities develop. Profit maximization involves maximizing a composite net return for two or more levels in the production-marketing sequence. It is likely total net returns to the producer will be maximized at a volume of output which would be neither the optimum "marketing plant" nor "production plant" output. This, of course, may be the result of contracts with private firms if bargaining power is not evenly divided. This suggests interesting research in the area of interrelationships of growers and marketing firms.

The way in which these compromise decisions are manifested will affect on-the-farm resource efficiency. If the marketing firm agrees to supply certain inputs with the objective of creating a market for these supplies, the farmer may be obligated to use more of this factor than if he were farming without contract. A pre-mixed feed may not be balanced in the way the farmer would mix the feed if he were mixing his own. To the extent these supplies can be substituted for other inputs, a different combination of factors may result than if the farmer were operating without a contract. The quantity produced may also be subject to negotiation,

and the farmer may produce more or less of a commodity in order to get a contract than he would for the open market. Although it is probable that the over-all effect of integration will result in greater efficiency, it may not result in the most efficient use of resources on the individual farm. The analysis of various types of contract, both from an efficiency and from an income transfer standpoint, offers possibilities. The framework that has been developed in connection with tenure analysis will have application here.

There is little reason to believe production function analysis will be any less valuable with integration. On the contrary, two considerations drive one to the opposite conclusion. In the first place, fieldmen are more apt to be production specialists than the individual farmer. Therefore, they may make more application of technical information than the farmer who has been producing a variety of agricultural commodities. This trained specialist will be less interested in recommendations and more interested in basic relationships. In the second place, the removal of price uncertainty by the use of contracts may make portions of the theory of the firm more applicable. While it is true a firm, in the classical sense, no longer exists, the basic technical unit production functions will still be necessary for decision making. Static analysis, which, in the past, has been assumed in the face of obvious uncertainties, may be more realistic in the future.

The problem of technical uncertainty may also be worth mentioning. It is somewhat questionable that complete integration can occur for a commodity that is faced with considerable technical uncertainty. An exception would exist if technical uncertainty faced the individual farmer but did not exist for farmers as a whole producing under contract. If the supply cannot be predicted, it is doubtful that a predetermined contract price can be set. If the quantity varies, price may have to be left open to adjust the supply with demand. If a price can be set in advance, this probably will mean technical uncertainty will also be low. This merely enhances the value of production function analysis.

Traditional farm management studies that place emphasis on finding the optimum farm plan may need to change their emphasis somewhat. It may well be that farms in the future will fall into four groups:

1. Those that are integrated by ownership.
2. Those farms that are completely integrated by means of contract.
3. Those farms that are partially integrated.
4. Those that farm without integration.

No one can predict at this time the relative importance of the various groups. However, the best information at present would indicate there

will be sizable numbers of groups (2), (3) and (4). The author has no predictions as to the eventual size of group (1).

Those farms that are integrated by ownership, that is, when (say) the processor is the owner, will still have need for determining the best combination of enterprises for a particular farm. However, the client of the researcher is no longer the grower but is the owner of the integrated firm. Technological factors such as fertility, weeds, insects, will have to be taken into consideration as well as market outlets. It may well be that some of the products will be sold unprocessed. Also, rotations may be developed on a farm-to-farm basis rather than on a field-to-field basis.

For the farmer who is integrated by contract, it appears the main management decision will involve which contracts to sign. This comes down to the question of the most profitable combination of enterprises based on the contracts available.

At present it appears there may be a sizable number of farmers who will be producing part of their output under contract but will be selling the remainder on the open market. These farmers will have some problems peculiar to this arrangement. There may be one crop, grown under contract, that is clearly the most profitable for the individual farmer. The problem will be that of using the remaining resources most efficiently. This calls for nothing new in methodology, paralleling the problem of adapting the farm to allotment programs.

It does not appear that the problems of the fourth group will change greatly. If integration proceeds rapidly, the farmers in group four will consist mostly of small low-income or part-time farmers. Anyway, there is real question as to whether traditional farm management research has much relevance to the low-income farm problem.

Extension Implications

There are obvious extension implications of integration. The client of the extension service may shift from the individual farmer to the fieldman for a marketing firm. Many county extension agents in Oregon are feeling the impact of integration and are searching for a new approach to meet their changed situation. Perhaps research efforts are needed to identify the real decision makers so that extension will know who their clients really are. As mentioned earlier, the fieldman probably will be better trained and more progressive than the average farmer. The county agent cannot expect to match the fieldman's technical ability in certain areas. This new situation is both a threat and an opportunity. It threatens to take from the county agent some of the functions he has been performing and may remove his entree to many farmers. On the other hand, it

affords an opportunity for him to do some general educational work he previously has not had time to do. Public policy education and general management advice are possibilities.

Of course, the fieldman for the marketing firm will still need information. The central extension staff is more likely to have the necessary specialists to supply the type of information needed. Integration may well have more drastic extension implications than it does in research.

Broader Implications

There are other questions that arise from integration not so easily treated as those mentioned above. The whole question of impact on the individual farmer is an example. If the farmer becomes dependent upon a contract, is he substituting long-run dependence on an impersonal marketing firm for short-run price uncertainty? What are the sociological implications in regard to the family farm? Some say integration is inevitable and that any catalogue of undesirable effects is academic. From a scientific standpoint, such a position is untenable. Knowledge of all the effects will be helpful in using this new force for the general welfare.

There is also the question of who should be doing research for the integrated firm. The agricultural experiment stations were originally established to do research because the individual farmer was too small to finance research. If food output comes under the control of a relatively small number of firms, should society foot the research bill for these firms? Will the benefits of this research be passed on to the consumer with the necessary rapidity? What will happen to the independence (assuming they still have some) of experiment stations and the extension service if their chief clients are a small number of integrated farms or even a smaller number of food distributors?

The answer may lie in the direction of the research undertaken by the experiment stations. "Bread and butter," or highly applied research may be more efficiently performed by a large marketing firm than by an experiment station. On the other hand, experiment stations may have a comparative advantage in doing work of a more fundamental nature.

Summary and Conclusions

If integration should proceed to encompass a major portion of American agriculture, there will be many implications as far as agricultural economics research is concerned. Traditional farm management problems will still exist. However, the clientele for farm management research may shift from the farm manager to the personnel within the integrating firm. These people probably will be more highly trained in the production of their particular commodity. Therefore, they undoubtedly will be more

interested in the basic relationships involved in a production problem than they will in an experiment station recommendation unaccompanied by supporting evidence.

Research on whole farm planning problems may have to be changed somewhat as to focus and restrictions for the partially integrated farm. The quantity of the contracted crop that is to be produced may cease to be a variable to be determined; rather, it will be a requirement that will have to be met. The specification of a contract price may make traditional static models more, rather than less, realistic. Since the users of research results may change, integration may have profound extension implications.

There are many important questions raised by integration that deserve answers. Many of these questions fall outside traditional farm management. Integration will not remove the need for farm management research, although in some cases the direction may be changed.

ADJUSTMENT OPPORTUNITIES AND THE COTTON ACREAGE RESERVE PROGRAM

J. E. FARIS AND YAIR KADISHAY
University of California, Davis

COTTON acreage in California has decreased by approximately 50 per cent since 1953 as a result of acreage allotments and marketing quotas imposed from 1954 to the present. The farmer is faced with the problem of determining the most profitable alternative use of the resources formerly used in cotton production. In the 1957 crop year an additional alternative, the cotton acreage reserve, was made available to cotton producers. Thus, the farm operator had the alternative of not planting all of his cotton allotment and receiving compensation from the government for *reserving* up to 30 per cent of his allotment as well as using the freed resources for other crops.[1]

The purpose of this paper is to examine the effect of the 1956-57 cotton acreage reserve program on optimum farm organizations under certain specified conditions. Considerable emphasis will be placed on the analysis and interpretation of the results in terms of the decision-making processes of farmers.

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[1] Cotton producers were not permitted to place more than 30 per cent of their cotton allotment in the cotton acreage reserve program during the 1957 crop year *unless* the acres of cotton acreage reserve allocated to the county were in excess of that required to cover all agreements. If this situation existed the farmers were permitted to place additional acres in the reserve program.

Framework of Analysis

The research technique employed to select the most profitable combination of resources is that of linear programming. A description of the natural and other physical resources in Western Fresno county, California, helped provide a basis for specifying a framework of analysis. A representative farm with two sections of land was constructed using data from a complete enumeration of cotton farms in Western Fresno county.[2]

Certain realistic constraints need to be explicitly specified for resources available to the farm operation. The restrictions placed on the availability of land, water and the cotton allotment are presented in Table 1. The

TABLE 1. RESOURCE RESTRICTIONS FOR COTTON FARMS, WESTERN FRESNO COUNTY, CALIFORNIA[a]

	Unit	Farms with		
		One soil grade	Two soil grades	Three soil grades
1	2	3	4	5
Land:[b]				
Grade I soil	acre	1,230	915	750
Grade II soil	acre	0	315	258
Grade III soil	acre	0	0	222
Irrigation water:				
3/1 -3/31	ac. in.	3,984	3,984	3,984
4/1 -4/30	ac. in.	3,840	3,840	3,840
5/1 -5/31	ac. in.	3,624	3,624	3,624
6/1 -6/15	ac. in.	1,752	1,752	1,752
6/16-6/30	ac. in.	1,608	1,608	1,608
7/1 -7/15	ac. in.	1,608	1,608	1,608
7/16-7/31	ac. in.	1,536	1,536	1,536
8/1 -8/15	ac. in.	1,440	1,440	1,440
8/16-8/31	ac. in.	1,536	1,536	1,536
Cotton allotment	acre	238	238	238

[a] An additional restriction for those farms participating in the cotton acreage reserve program is that not more than one-half of the cotton allotment can be placed in the cotton acreage reserve.

[b] Grade I soil is the most productive and Grade III soil the least productive soil.

farms are assumed to have varying proportions of three different soil grades with Grade I soil being the most productive and Grade III soil the least productive. It is also assumed that farm operators will not place more than 50 per cent of their cotton allotment in the cotton acreage reserve.

Information from several sources was synthesized into "standards" which represent typical techniques of production used by the farmers

[2] A representative farm with five sections of land was also constructed. However, because of the similarity of results for the different size farms, the discussion in this paper will be centered on the smaller size farm.

in Western Fresno county or techniques recommended by specialist for the area. In forming price and cost expectations, "normal" price relationships were sought. An enterprise budget was constructed for each alternative enterprise considered as a production possibility by type of soil. Yields and net cash return by type of soil are presented in Table 2 for each alternative enterprise considered.[3]

TABLE 2. YIELDS AND NET CASH RETURNS BY SOIL GRADE, WESTERN FRESNO COUNTY, CALIFORNIA

Enterprises	Soil Grade I		Soil Grade II		Soil Grade III	
	Yields	Net cash returns (dollars)	Yields	Net cash returns (dollars)	Yields	Net cash returns (dollars)
1	2	3	4	5	6	7
Alfalfa hay	7.5 ton	45.79	6.25 ton	24.02	[a]	[a]
Alfalfa seed	750 lbs	67.50	550 lbs	19.03	300 lbs	[b]
Barley	33 cwt	40.76	25 cwt	21.86	20 cwt	9.55
Castor beans	25 cwt	56.42	20 cwt	27.32	17 cwt	9.86
Field corn	50 cwt	47.43	45 cwt	35.38	40 cwt	23.32
Cotton	1125 lbs	244.92	875 lbs	164.93	[a]	[a]
Cotton acreage reserve	875 lbs	127.68	625 lbs	90.18	[a]	[a]
Flax	35 cwt	39.82	27 cwt	15.07	18 cwt	[b]
Melons	175 crate	118.52	165 crate	105.02	140 crate	71.27
Milo	50 cwt	73.98	45 cwt	61.92	40 cwt	49.86
Safflower	25 cwt	25.46	20 cwt	8.28	16 cwt	[b]

[a] Not considered as a production possibility.
[b] Negative net cash return.

All of the alternative enterprises are presently being produced in Western Fresno county. However, the melon enterprise is not available to all farmers in the area because of the lack of packing and marketing facilities. Melons were selected because they are the most important specialty crop in Western Fresno county and because specialty crops as a whole are very important to farmers in the area.

Optimum Farm Organizations

Optimum farm organizations for farms with and without the melon enterprise and the cotton acreage reserve enterprise are presented in Table 3. When the melon enterprise is excluded as a production possibility, cotton acreage reserve does not enter into the optimum programs under the assumed price and production conditions (see programs S-A-1, S-A-2 and S-A-3). When melons are considered as an available enterprise,

[3] Net cash return is defined as the difference between gross receipts from the sale of the product produced by a process less the cash expenses and interest on operating capital.

TABLE 3. OPTIMUM FARM ORGANIZATIONS AND NET CASH RETURNS FOR FARMS WITH AND WITHOUT THE MELON AND THE COTTON ACREAGE RESERVE ENTERPRISES ON ONE, TWO, OR THREE GRADES OF SOIL

Alternatives and crops produced	Acres of each crop selected for farms with:							
	One grade of soil	Two grades of soil			Three grades of soil			
	Grade I	Grade I	Grade II	Total	Grade I	Grade II	Grade III	Total
1	2	3	4	5	6	7	8	9
Farms without the melon enterprise	(S-A-1)	(S-A-2)			(S-A-3)			
Barley acres	674	674	0	674	512	162	0	674
Milo acres	70	3	67	70	0	70	0	70
Cotton acres	238	238	0	238	238	0	0	238
Acreage reserve acres	0	0	0	0	0	0	0	0
Idle land acres	248	0	248	248	0	26	222	248
Net cash return dollars	90,940	—	—	90,130	—	—	—	87,040
Farms with the melon enterprise	(S-B-1)	(S-B-2)			(S-B-3)			
Including the acreage reserve enterprise:								
Barley acres	755	614	98	712	470	182	22	674
Milo acres	58	0	0	0	0	0	0	0
Alfalfa seed acres	52	63	0	63	42	0	0	42
Melons acres	127	0	115	115	0	76	0	76
Cotton acres	147	195	0	195	238	0	0	238
Acreage reserve acres	91	43	0	43	0	0	0	0
Idle land acres	0	0	102	102	0	0	200	200
Net cash return dollars	101,250	—	—	96,750	—	—	—	92,450
Excluding the acreage reserve enterprise:	(S-C-1)	(S-C-2)			(S-C-3)			
Barley acres	674	635	39	674	470	182	22	674
Alfalfa seed acres	42	42	0	42	42	0	0	42
Melons acres	76	0	76	76	0	76	0	76
Cotton acres	238	238	0	238	238	0	0	238
Idle land acres	200	0	200	200	0	0	200	200
Net cash return dollars	97,600	—	—	95,840	—	—	—	92,450

farms with one or two grades of soil can increase net cash returns from the farming operation by participating in the cotton acreage reserve program (compare programs S-B-1 and S-B-2 with programs S-C-1 and S-C-2). Participation in the acreage reserve program permits the farm operator to utilize land that would otherwise remain unused in the sense that no net cash return would be forthcoming from the idle land.[4] However, it does not "pay" the farm operator with three grades of soil to participate in the cotton acreage reserve program.

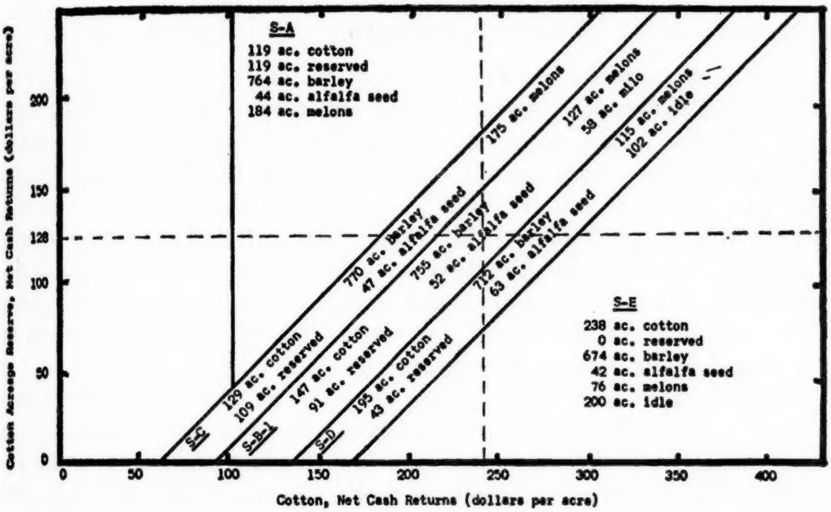

FIG. 1. Stability Boundaries for Optimum Organizations with Respect to Changes in Net Cash Returns from Cotton and Cotton Acreage Reserve for Farms with One Grade of Soil and the Melon Enterprise.

Stability boundaries for cotton and cotton acreage reserve on the farm with one grade of soil and the melon enterprise available are presented in Figure 1.[5] It was assumed in the initial programs that the net cash return from the cotton acreage reserve enterprise on Grade I soil was approximately $128 per acre (15¢ per pound of lint for an 875 pound yield less $3.50 for keeping the land in good potential use). For farms with one grade of soil, enterprise combination S-B-1 would be optimum if the net cash return from cotton acreage reserve varied between $106 and $152 per acre (ceterus paribus). A decrease in the proportion of the

[4] Actually there may be a cost (a negative net return) associated with idle land in order to keep it in good potential use, i.e., weed control.

[5] Stability boundaries denote the limit within which net cash returns from cotton and cotton acreage reserve can vary without changing the optimum combination of enterprises.

better soils has the same effect as decreasing the net cash return from the cotton acreage reserve program. The optimum enterprise combinations S-D and S-E in Figure 1 for the farm with one grade of soil are identical with optimum enterprise combinations for two grades of soil (S-B-2) and three grades of soil (S-B-3), respectively (Table 3). Thus, a decrease in the proportion of the better soils shifts the stability boundaries to the left. This is interpreted as meaning that the lower the proportion of better soils the less profitable the cotton acreage enterprise is in relation to the cotton enterprise.

Conclusions

The above analysis has indicated that under the assumed price, cost and yield conditions, it would be profitable for farms on the better soils and with the melon enterprise available to place part of their cotton allotment in the cotton acreage reserve program. On the farms with one and two grades of soil, it would be profitable to place 38 per cent and 18 per cent, respectively, of the cotton allotment in the acreage reserve program. Assuming that 40 per cent of the farmers in the area have the alternative of producing melons or a similar specialty crop, it would have been profitable for less than 7 per cent of the total cotton allotment to be placed in the reserve program.[6]

Approximately 9 per cent of the total cotton acreage allotment was signed up by California cotton producers under the 1957 cotton acreage reserve program.[7] These agreements to participate in the program required only 37 per cent of the total funds allocated to California for the cotton acreage reserve program. It is doubtful if even 9 per cent of the total cotton acreage in Western Fresno county was signed up to participate in the reserve program.

Why did the cotton acreage reserve program fail to attract more farmers to participate? The above analysis indicates that for many of the California farms the payment for reserving cotton acreage was too low.[8] The payments for reserving cotton acreage would have to increase \$20.00 per acre before the farm without the melon enterprise and only the best soil would include any cotton acreage reserve in the optimum program. On farms with less productive soils an even larger increase would be required. However, it would only require an increase of \$7.00 per acre before the farm with three grades of soil and the melon enterprise would include 43 acres of cotton acreage reserve in the optimum program.

Although the analysis indicates that it would be profitable for some

[6] This assumes that 60 per cent of the farms have only one or two soil grades.
[7] California stabilization and conservation committee.
[8] An analysis of larger cotton farms in this area resulted in the same conclusion.

of the farms to participate in the acreage reserve program, the net cash returns would only be increased by 4 per cent on the farm with one grade of soil and by 1 per cent on the farm with two grades of soil. An increase of this magnitude may not appear very large to farmers with total net cash returns of $90,000 to $100,000 from farming. Another reason for the lack of participation in the reserve program was the lack of knowledge on the part of the operator. Cotton producers have been in a state of flux concerning which enterprises to produce since 1954 when the cotton allotments were sharply decreased. Thus, they were uncertain with respect to the prices, costs and yields of crops other than cotton and barley.

Cotton Acreage Reserve Program for the 1958 Crop Year

Several major changes in the cotton acreage reserve program are being made for the 1958 crop year. The first major change is that of placing a maximum of $3,000 on the amount that each farm unit can receive for participating in the reserve program.[9] This amounts to 24 or less acres that can be reserved. It is doubtful if farms the size of those considered in this investigation would participate under such a small limit.

The second, and perhaps more critical change in the program, is that the farm operator in this area would be required to reduce the total acreage of all crops, with the exception of permanent legumes, by the number of acres placed in the reserve program. The cotton acreage reserve would not enter into the optimum program under this condition because permanent legumes (alfalfa) require more water than cotton in a very critical time period, and the net cash return per acre from the alfalfa and the cotton acreage reserve enterprises is less than the net cash return per acre from cotton.

As a result of these two major changes in the cotton acreage reserve program for the 1958 crop year, it appears that participation in the program by California farmers will be less, and perhaps considerably less, in 1958 than in 1957.

[9] Information obtained from a representative of California Agricultural Stabilization and Conservation Committee at Berkeley, California.

SOCIOECONOMIC CHARACTERISTICS OF INNOVATORS[1]

PETER E. HILDEBRAND AND EARL J. PARTENHEIMER
Michigan State University

RECENTLY there has been an increased interest in the study of the process of management as opposed to studying the physical and economic aspects of farm management problems. As part of a related development, Beal and Bohlen[2] have summarized a number of sociological studies dealing with the process by which farm managers accept new ideas. Their principal topic is the diffusion of new ideas, which they divide into five stages—awareness, interest, evaluation, trial, adoption. Two other major topics discussed by Beal and Bohlen are individual differences and the effect of such differences on the adoption of new ideas by farmers.

The Interstate Managerial Survey, which was discussed at, and following, the East Lansing meetings of the AFEA[3] produced information which can be compared with that reported by Beal and Bohlen. However, it should be remembered in the discussion which follows that the IMS was not designed for this specific purpose. Also, it should be kept in mind that the IMS is a farm management study while Beal and Bohlen summarized primarily sociological studies.

Beal and Bohlen classify farmers on the basis of the time it takes them to adopt new ideas. Their classification contains five groups: innovators, early adopters, early majority, majority, and nonadopters. IMS data do not permit division of farmers into such fine categories. However, responses to one question can be used to divide those who would be more likely to be first from those who would be less likely to be first to adopt new ideas. For brevity, the first group is designated innovators; the second group, non-innovators.

The IMS question was:

"Assuming for a moment, that there will be changes in farming methods and equipment, would you be willing to be the first one in your area to try out some of these changes, or would you prefer to have some other farmer try them out before you adopt them?"

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[1] Michigan Agricultural Experiment Station Journal Paper No. 2182. This paper is the result of a suggestion by G. L. Johnson and has benefited from his criticisms. The authors also wish to acknowledge helpful criticisms and suggestions from Charles Beer, G. I. Trant, and A. R. Bird. Errors and omissions are, of course, those of the authors.

[2] Bohlen, Joe M. and Beal, George M., *How Farm People Accept New Ideas*, Special Report No. 15, Agricultural Extension Service, Iowa State College, November, 1955. *The Diffusion Process*, Special Report No. 18, Agricultural Extension Service, Iowa State College, March, 1957. These are summaries of a flannelgraph presentation by Beal and Bohlen.

[3] See, *Journal of Farm Economics*, December, 1955, p. 1097f.

This question was asked of 184 farmers. Of this group, 66 indicated they would be willing to be first; 92 would prefer to wait for others; 22 gave answers such as "it depends" or, "don't know"; and 4 did not answer the question. Of the total, 36 per cent indicated they would be willing to be first. This is the innovator group. The non-innovators include only those 92 farmers who indicated they would prefer to wait for others. As there was no basis for including the remaining 26 respondents in either group they are not discussed. The chi-square test of significance was used; the highest level at which the relationships are significant is footnoted.

The data showed that the innovators had more formal education and were more likely to have had agricultural training during their formal schooling.[4] There was a definite break between those who had an eighth-grade education or less and those with more than an eighth-grade education[5] which concurs with the findings of Beal and Bohlen. Those who had adult vocational agricultural training and mechanical training related to agriculture were more likely to be innovators, while those who had received training under the veteran's training program showed a distinct tendency toward being non-innovators.[6] Previous participation by respondents in 4-H, FFA, or both, was positively associated with innovation.[7]

Also in agreement with the summary of Beal and Bohlen is the tendency of the younger men to be innovators.[8] There was a rather constant downward trend in this tendency with increase in age. The number of years a person had been in farming did not follow this pattern exactly. Those who had farmed less than 20 years were more likely to be innovators than those who had farmed 21-40 years. In an intermediate position were those who had farmed for more than 40 years.[9] Since the data were collected in the summer of 1954, the two breaks would come in 1914 and 1934. The results suggest a tentative hypothesis that the likelihood of being an innovator is related to the trend in farm prices during the first few years of farming.

Part-time farmers appear much more likely to be innovators than full-time farmers.[10] If everyone who does *any* off-farm work is classified as a part-time farmer, 35 per cent of this group are innovators as compared with only 15 per cent of the full-time farmers. There was a tendency among the part-time farmers for the proportion of innovators

[4] Significant at .98 level.
[5] Significant at .999 level.
[6] Significant at .95 level.
[7] Significant at .90 level.
[8] Significant at .90 level.
[9] Significant at .95 level.
[10] Significant at .98 level.

to increase with the amount of part-time work and the proportion of income from nonfarm sources.

More respondents with an average yearly gross income of $18,000 or over were innovators than those with an average gross income of less than $3,500. Farmers in between these two groups were intermediate with respect to innovation.[11] Net worth condition followed a somewhat different pattern. A relatively high proportion of the farmers with high net worth were willing to be innovators. However, those with low net worth were somewhat more willing to innovate than those in an intermediate net worth position.[12] Contrary to the findings reported by Beal and Bohlen, the amount of debts and the debt-asset ratio were not associated with innovation.

Farmers who hire labor were more likely to be innovators than those who used only family labor.[13] A much higher proportion of those who rented part of their land were innovators than those who owned all their land. Farmers renting all their land were in an intermediate position.[14] Also, as the size of farm (acres in crops and rotation pasture)[15] increased, the proportion of respondents classified as innovators increased.[16]

In general, the IMS data substantiate the findings reported by Beal and Bohlen. However, in the IMS data, there was no significant relation between innovation and participation by the farmers' children in 4-H or FFA. The information given by Beal and Bohlen states a positive correlation in this respect. Some of the characteristics of innovators given by Beal and Bohlen which are substantiated by IMS data are: more education, younger, greater net worth, larger farms, and more participation in adult extension programs.

Beal and Bohlen make reference to the sources of information used in the various stages of the diffusion process and in relation to the respective rates of adoption. The IMS shows little difference between sources of communicative information used by innovators and non-innovators. The IMS question was more concerned with what sources were used rather than when and by whom they were used and can, therefore, not be held to be a sufficient basis for assessing Bohlen and Beal's ranking.

Inspection of the IMS data shows that a very important category of information sources is the non-communicative category. The studies summarized by Beal and Bohlen have neglected this category. Of both

[11] Significant at .99 level.
[12] Significant at .90 level.
[13] Significant at .99 level.
[14] Significant at .999 level.
[15] Significant at .99 level.
[16] Increased size may be considered by some as innovation in itself.

communicative and noncommunicative sources considered in the IMS, the most important was "past experience"—a noncommunicative source. Beal and Bohlen have made reference to one of these noncommunicative sources, trial on a limited scale, and have also alluded to "observing the experience of others" as contrasted with "talking about a project to neighbors and relatives." Other noncommunicative sources include "written records" and deduction from known information.

As mentioned by Glenn Johnson in a paper delivered at the recent North Carolina meeting of the AFEA, the studies summarized by Beal and Bohlen neglect the farmer's use of statistical procedures, economic principles, and technical disciplines in the decision making process. Another neglected aspect of management is responsibility bearing.[17] The acceptance of responsibility for the decisions is an integral part of the process. Logically, each step of the diffusion process is affected by responsibility bearing.

The diffusion process can be accelerated if initial efforts are directed to those farmers inclined toward innovation. Knowledge of the socio-economic characteristics of innovation can aid in selecting farmers who would be most receptive to new technology.

[17] Unless one considers this implied in the adoption process.

NOTE ON TRANSPORTATION AND ASSIGNMENT PROBLEMS

WILFRED CANDLER
The University of New England, N.S.W. Australia

TWO recent articles have discussed the solution of transportation and assignment problems.[1] Both methods call for a *complete* revaluing of *all paths*, routes, or arrows, after each change of route loading. Much faster solutions can be obtained by taking advantage of the fact that *if after a change of route loading, the activated paths (or arrows) used to value an inactive path remain active, then the value of the inactive path remains the same*. Hence, if after valuing all routes a route is activated and it is still possible to activate another route (that would originally have given a saving), then a saving will be made by activating this route. This principle does not stop for only two routes; three, four or any number of routes can be activated successively with successive

[1] Milton M. Snodgrass and Charles E. French, "Simplified Presentation of the 'Transportation Problem Procedure' in Linear Programming," *Journal of Farm Economics*, Vol. 39, February, 1957, p. 40; and Daniel B. Suits, "Solution of Assignment Problems by Directed Graphs," *Journal of Farm Economics*, Vol. 39, November, 1957, p. 975.

savings, provided that in the transportation problem these adjustments do not demand negative route loadings.

This principle may be illustrated from the assignment problem discussed.[2] The heavy arrows of Figure 1 give the original routes. The figures with 1 superscript give the original route loadings. The dotted arrow corresponds to the activation of route A_{31} and the figures with 2 superscript indicate the second route loadings. Now, we note that the valuation of route A_{21} both before and after the activation of route A_{31} depends only on routes A_{42} and A_{41}; hence, its value is the same before

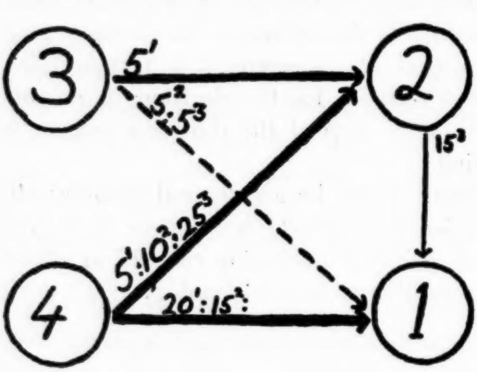

FIGURE 1

and after the rerouting, and a further saving of 2 per unit can be achieved by routing the supply from (4) to (1) via (2). The final route loadings appear with a 3 superscript in Figure 1.[3]

In this way it may be possible to make several successive improvements in the route loadings without having to go through the labor of revaluing all routes.

Several other short cuts are available elsewhere[4] but the above saving seems sufficiently important to be reported at once.

[2] Daniel B. Suits, op. cit.

[3] And will be seen to correspond to the optimum route loadings of Figure 5, p. 982 of Daniel B. Suit's article.

[4] E. O. Heady, and W. Candler, "Linear Programming Methods," Iowa State College Press, 1958.

PRODUCTION FUNCTIONS FROM DATA OVER A SERIES OF YEARS

WILLIAM G. BROWN AND MERRILL M. OVESON
Oregon State College and Pendleton Branch Experiment Station

CERTAIN problems are encountered in the estimation and use of production functions from experimental data covering a period of several years which do not occur when results from only one year are considered. There has been some discussion as to which estimate of the production function should be used when the producer is faced with a probability distribution of production functions.[1] Some have suggested that the modal function (the function with the highest probability of occurrence) be used in preference to the average production function calculated from data over all the years.

Despite the fact that a modal function fitted from data of "typical" years might have a higher probability of occurring, the "average" function (calculated from data over all the years) has certain properties which makes it "better" than any other estimate such as the modal or median function.[2] Besides, having minimum variance, the least squares average function is unbiased. That is, the coefficients of the average function have an expected value equal to the corresponding population parameters.

If the farmer wishes to maximize expected profit over the entire period, then the mean function is optimal since it gives the best estimate of the marginal productivities associated with specified factor inputs.[3] The mean

[1] For example, see Earl O. Heady, "Economics of Agricultural Production and Resource Use," Prentice Hall, Inc., 1952, pp. 486-489. Also, David D. Mason, "Statistical Problems of Joint Research," *Journal of Farm Economics,* Volume 39, No. 2, May 1957, pp. 373-374.

[2] To keep the problem manageable, the not unreasonable assumption is made that the functions making up the probability distribution of production functions are all of the same algebraic form. Unless this assumption is made, it seems doubtful if generalizations regarding the mean, modal, or median functions would have operational significance.

[3] Some principle of choice other than the traditional maximization of profit could be employed, of course, since no single principle thus far advanced seems to be universally acceptable as a rule for selecting a particular course of action. It has been noted that the form of the decision model employed could affect the choice of the optimal estimate of the production function. For example, a conservative principle of choice would favor the selection of estimates giving lower marginal products than the mean. This fact is illustrated by the data in Table 1. Under current prices, there are no rates of application which were not unprofitable in at least one of the 10 years. The only way to be sure of not losing money on fertilizer in any one year would be to refrain from applying any.

In the author's opinion, the effect of risk and uncertainty are best handled by reducing application rates to a point where discounted expected marginal returns per dollar expended for fertilizer are comparable to discounted expected marginal returns in alternative investments available to the firm. Employment of some conserva-

function thereby would be the relevant function to use in determining economic optimum inputs when the deviations of particular responses from the average cannot be predicted in advance.[4]

An empirical illustration of the preceding is provided by experimental results from continuous spring wheat over a 10-year period at the Pendleton Branch Experiment Station, Oregon.[5] In Table 1 the average yields at each level of nitrogen are given. Although there is considerable variation in yields from year to year, there is a pattern to the yearly response curves. The increase in yield from nitrogen application can be seen more clearly in Figure 1.

TABLE 1. AVERAGE YIELDS IN BUSHELS PER ACRE OF CONTINUOUS SPRING WHEAT AT SPECIFIED LEVELS OF NITROGEN, PENDLETON BRANCH EXPERIMENT STATION, PENDLETON, OREGON. THE 30, 60 AND 90 POUND ENTRIES REPRESENT TWO OBSERVATIONS: CHECK PLOTS HAD AN ADDITIONAL REPLICATION

Year	Pounds of Applied Nitrogen Per Acre			
	0	30	60	90
1944	12.5	10.8	16.8	13.05
1945	11.27	18.35	13.35	13.1
1946	17.5	29.8	43.7	47.55
1947	13.9	26.5	31.1	30.9
1948	9.8	20.75	25.55	24.6
1949	8.0	11.4	12.55	14.4
1950	18.23	23.8	21.05	17.1
1951	16.4	26.65	32.05	29.35
1952	18.87	33.35	36.35	34.50
1953	13.97	19.35	31.25	29.45
Average	14.04	22.08	26.38	25.40

Total corrected Sum of Squares................ 8191.20

The yield response was greatest in 1946 with increased yields of 25 to 30 bushels per acre at the high rates of nitrogen. In 1947, 1948, 1951, 1952, and 1953 the yield response to fertilizer was good although not so spectacular as in 1946. In 1944, 1945, 1949, and 1950 the increase in yield was meager; nitrogen did not seem to help much in these four years.

tive principle of choice designed to minimize possible losses or income variability does not seem to be an adequate answer to the problem of determining optimum fertilizer rates.

[4] The preceding statements are most easily shown where the variances of the different treatments are homogeneous. Where the treatment variances differ significantly, the problem becomes more complex. Weighted regression has been used in such cases whereby each treatment is assigned a weight inversely proportional to its variance. See Thomas E. Tramel, "Distributions of the Fertilizer Production Functions in Relation to Decision-Making," Ph.D. Thesis, Iowa State College Library, Ames, Iowa, 1954.

[5] See W. G. Brown and Merrill M. Oveson, "Profitability of Fertilizing Wheat in Umatilla County," Oregon Agricultural Experiment Station Circular 583, October, 1957.

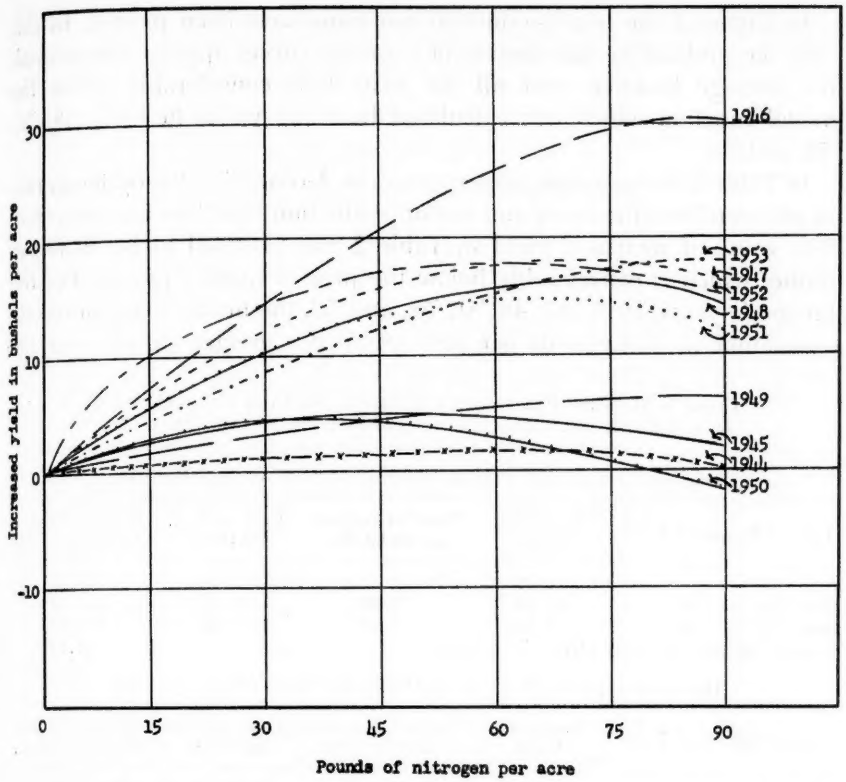

FIG. 1. Estimated yield responses to nitrogen from continuous spring wheat at Pendleton Branch Experiment Station for the years 1944 to 1953. Yield response curves for each year were estimated from the increase in yields over check plots at 30, 60, and 90 pounds of nitrogen.

On the basis of the yield increases over check plots, "similar" years were pooled and regressions were estimated for each set of similar years. In the following equations, Y refers to predicted yield in bushels per acre, while N refers to pounds of elemental nitrogen applied per acre.

(1) 1946, $Y = 17.1 + 0.5512N - 0.002292N^2$

(2) 1947, '48, '51, '52, '53, $Y = 14.5 + 0.4758N - 0.003386N^2$

(3) 1944, '45, '49, '50, $Y = 12.6 + 0.1478N - 0.001431N^2$

(4) Over all years, $Y = 14 + 0.35214N - 0.0024946N^2$

All the above regressions were statistically highly significant except the regression for the years 1944, '45, '49, and '50. However, even this regression is significant when prediction of yield *increase* from nitrogen is considered.[6]

[6] The main purpose of the yield-fertilizer function in this case is to predict increases in yield at various rates of N rather than total yield.

In Figure 2 the four production functions have been plotted. In this case the probability distribution of response curves appears non-normal; the average function over all the years falls considerably below the modal function which was calculated from the yields in 1947, '48, '51, '52, and '53.

In Table 2 the economic consequences of determining the optimum rate of nitrogen from the mean and modal production functions are presented. The value of increased yield in Table 2 was assumed to be $0.89 per bushel which is considerably below the present market prices.[7] For the favorable years, 1946, '47, '48, '51, '52, and '53, the modal function recommendation of 40.4 pounds per acre returned a greater margin over the

TABLE 2. MARGINS PER ACRE OVER FERTILIZER COST USING OPTIMUM INPUTS BASED ON AVERAGE VERSUS MODAL PRODUCTION FUNCTIONS

Optimum Input of 30 Pounds Determined from Average Function

Type of Response Year	Increased Yield	Value of Increase At $0.89/Bu.	Cost of N at $0.18/lb.	Margin Per Acre Over Cost of N.
1946	14.47	12.88	5.40	7.48
1947, '48, '51–'53	11.23	9.99	5.40	4.59
1944, '45, '49, '50	3.15	2.80	5.40	−2.60
Average Margin Per Acre Over All 10 Years				$2.00

Optimum Input of 40.4 Pounds Determined from Modal Function

Type of Response Year	Increased Yield	Value of Increase At $0.89/Bu.	Cost of N at $0.18/lb.	Margin Per Acre Over Cost of N.
1946	18.53	16.49	7.27	9.22
1947, '48, '51–'53	13.70	12.19	7.27	4.92
1944, '45, '49, '50	3.64	3.24	7.27	−4.03
Average Margin Per Acre Over All 10 Years				$1.77

cost of the nitrogen. However, margins in the four poor years were sufficiently less under the modal system to reduce the average margin per acre over all 10 years to $1.77, which was 88 per cent of the average margin for the mean.

Costs and returns in Table 2 illustrate the fact that the average production function over all the years is preferable to other estimates such as the median, mode, etc., when expected profit is to be maximized and there is nothing but past results to go on. For maximum profit over time, the average function will always give results which are as good or better than for any other single estimate when checked back against the functions for individual years or sets of years as in Table 2. The mode or

[7] The low price was selected in order to utilize a portion of the average function which differed in slope from the mode. Around 60 pounds of nitrogen the mean and modal response curves have nearly the same slope; consequently, the modal function would give results similar to the mean in the range around 60 pounds.

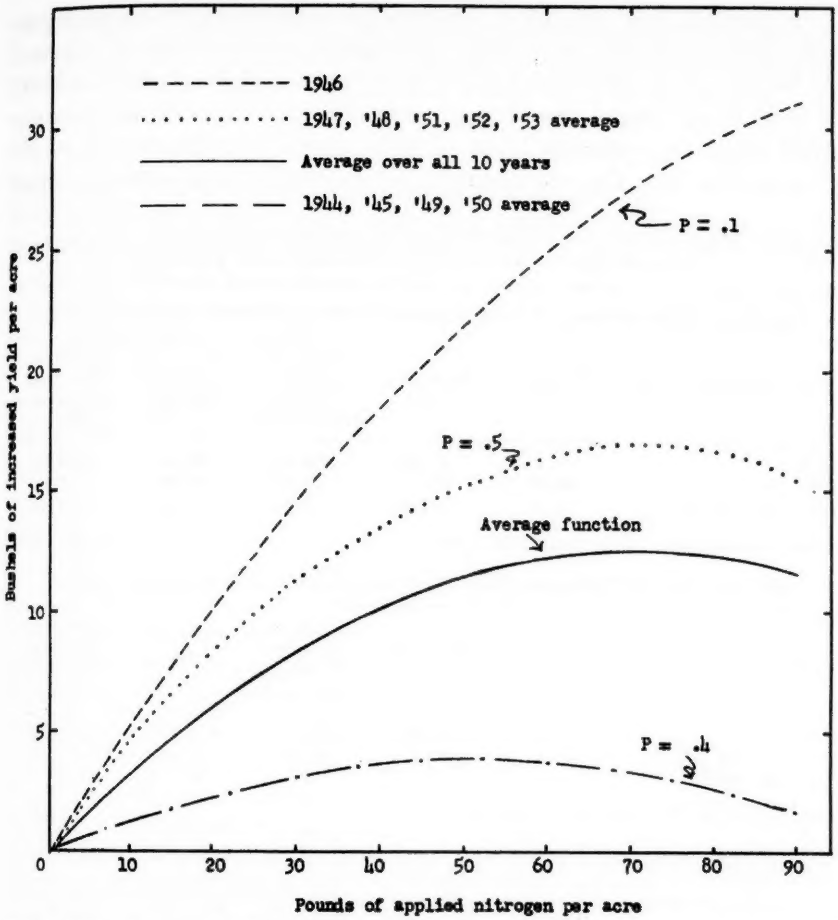

FIG. 2 Estimated probability distribution of production functions from 10 years of experimental results, Pendleton Branch Experiment Station, Pendleton, Oregon.

median would give results as good as the average production function only as they approach the mean function, as in a set of normally distributed functions.

Economic Feasibility of Using the Average Function for All Years

Since the average production function would be the "best" single estimate to use to maximize profit over time if the probabilities of each type of response were known and there were no "advance information" as to which type to expect in a particular year, just how good would results be from relying on this average function for every year? Of course, if the farmer could "anticipate" the correct type of response for the coming year, returns from fertilizer would be greater.

In Table 3, two cost-price situations are considered in comparing results from the optimum average application for each type of response. At the low price of $1.00 per bushel for increased yield of wheat and with N at $0.15 per pound, the average margin per acre over all the years was $4.09 when the optimum input of 40.5 pounds was determined by the average function; the average margin was $5.67 where optimum inputs

TABLE 3. MARGINS PER ACRE OVER FERTILIZER COST USING OPTIMUM INPUTS BASED ON AVERAGE VERSUS INDIVIDUAL TYPES OF RESPONSE FUNCTIONS

Optimum Inputs Determined From Average Function (Wheat at $1.00 per Bushel)

Type of Response Year	Pounds of N	Increased Yield	Value of Increased Yield at $1.00 Per Bu.	Cost of N at $0.15 Per Lb.	Margin Per Acre Over Cost of Nitrogen
1946	40.5	18.56	$18.56	$6.08	$12.48
1947, '48, '51, '52, '53	40.5	13.72	13.72	6.08	7.64
1944, '45, '49, '50	40.5	3.64	3.64	6.08	−2.44
Average Margin Per Acre Over All 10 Years					$ 4.09

Optimum Inputs Determined From Each Individual Type of Response Function

Type of Response Year	Pounds of N	Increased Yield	Value of Increased Yield at $1.00 Per Bu.	Cost of N at $0.15 Per Lb.	Margin Per Acre Over Cost of Nitrogen
1946	87.5	30.68	$30.68	$13.12	$17.56
1947, '48, '51, '52, '53	48.1	15.05	15.05	7.22	7.83
1944, '45, '49, '50	0	0	0	0	0
Average Margin Per Acre Over All 10 Years					$ 5.67

Optimum Inputs Determined From Average Function (Wheat at $1.80 per Bushel)

Type of Response Year	Pounds of N	Increased Yield	Value of Increased Yield at $1.80 Per Bu.	Cost of N at $0.12 Per Lb.	Margin Per Acre Over Cost of Nitrogen
1946	57.2	24.03	$43.25	$6.86	$36.39
1947, '48, '51, '52, '53	57.2	16.14	29.05	6.86	22.19
1944, '45, '49, '50	57.2	3.77	6.79	6.86	−0.07
Average Margin Per Acre Over All 10 Years					$14.71

Optimum Inputs Determined From Each Individual Type of Response Function

Type of Response Year	Pounds of N	Increased Yield	Value of Increased Yield at $1.80 Per Bu.	Cost of N at $0.12 Per Lb.	Margin Per Acre Over Cost of Nitrogen
1946	105.7	32.65	$58.77	$12.68	$46.09
1947, '48, '51, '52, '53	60.4	16.39	29.50	7.25	22.25
1944, '45, '49, '50	28.3	3.04	5.47	3.40	2.07
Average Margin Per Acre Over All 10 Years					$16.56

were determined according to the type of response year. The greatest loss from using the average function occurred during the most favorable fertilizer year, 1946, since only $12.48 would have been "cleared" per acre as compared to a maximum of $17.56 which would have been possible had the very favorable response been anticipated. Use of the average function in the unfavorable years would also have resulted in a loss of $2.44. If the unfavorable years had been foreseen, no fertilizer should have been applied with increased yield of wheat worth only $1.00 per bushel. In spite of these losses in the very favorable and unfavorable years, the average loss per year from the use of one rate determined by the average function was only $1.58 per acre.

In the bottom half of Table 3 a more favorable nitrogen-wheat price situation is assumed. With increased wheat yield valued at $1.80 per bushel and with N costing $0.12 per pound, a higher application of 57 pounds of N was specified by the average function. Under these prices, about $10 per acre more could have been realized if the very favorable response in 1946 could have been foreseen. Similarly, slightly over $2.00 more per acre could have been netted if the less favorable response in the four poor years could have been anticipated. However, in spite of these reductions the average margin per acre over all 10 years if 57 pounds of N had been applied would have been $14.71, only $1.85 under the average margin when the correct (in retrospect) type of response function was used to determine the optimum input.

In conclusion, for continuous spring wheat at Pendleton, Oregon, the use of the average function gave fairly good results when checked against the individual type of response functions. Of course, correlation of moisture and soil fertility measurements with crop response to fertilizer could permit considerable improvement in fertilizer recommendations if sufficient data were available.

A PARTIAL EVALUATION OF STATIC THEORY FROM RESULTS OF THE INTERSTATE MANAGERIAL SURVEY

DAVID H. BOYNE AND GLENN L. JOHNSON
Michigan State University

POLICY makers and both general and agricultural economists are confronted continually with questions concerning the relevance of static economic theory.[1] These questions arise at both micro and macro levels.

Among the general evidences of the relevance and usefulness of this static theory are the successes attained in the field of farm management when it is used in budgeting, continuous function analysis and linear programming. It has also proven useful in numerous aggregative price analyses and has a long established record of usefulness in formulating national policies.

There are also many indications of the deficiencies of static theory. They include the success of earlier approaches to farm management, some of which ignored static production economic theory; in fact, some of these other approaches with their emphasis on technological and human elements appear essential to a complete understanding of the management process and of solutions to farm management problems. Further evidence of the shortcomings of static theory is found in (1) the failure of static theory to explain much aggregative behavior and in (2) the obvious success of many national policies that are contrary to those suggested by static economic theory.

To throw a little more light on the usefulness, relevance and shortcomings of static theory, this paper examines data on some of the actual behavior of 1075 farmers in seven states. More specifically, this paper indicates, partially (1) what portion of the behavior of these farmers is consistent with static theory, (2) promising lines of modification in that theory and (3), incidentally, something about the applicability of other theories.

The study is based upon Interstate Managerial Survey data from four questions[2] pertaining to (1) organizational behavior, (2) responses to

[1] See Frank H. Knight, *Risk, Uncertainty and Profit,* Houghton Mifflin Company, Boston and New York, pp. 141-2 for a discussion of the meaning of statics and pp. 145-6 and especially 147 for some of the assumptions which are relaxed in converting a static system into one for studying secular change and progress. To get a more dynamic system which handles profits and the managerial process, the assumptions of perfect knowledge and foresight also have to be relaxed. See pp. 198f. It seems unnecessary to embark on a discussion of the various distinctions between statics and dynamics in every journal article and note. The views of one of the authors on this distinction are presented in "Needed Developments in Economic Theory as Applied to Farm Management," *Journal of Farm Economics,* Vol. 32, November 1950, Proceedings Number, pp. 1140-1158.

[2] These four questions were part of over 60 questions included in the IMS. Each

changing input prices, (3) responses to changing output prices and (4) managerial behavior when purchasing a major piece of farm machinery. The criterion for what evaluation of statics is attempted herein is consistency between static theory and observed behavior.

Organizational Behavior of Farm Managers

The most general of the four questions asked attempted to find out how farmers decide upon the organization of their business for a given year. Organization is used to refer to those aspects of a farm business which are not changed in the short run; organizing refers to the process of creating the organization. Operation and operating relate to the day to day and short run aspects of running a farm. More specifically, 172 of the 1075 farmers were asked, "Could you tell me how you made up your mind about what or how much of each product to produce this year?" The respondents gave answers which, when analyzed, indicated 347 uses of the following general response categories with the indicated percentages of the 172 farmers using each category.

Percentage of farmers	*Response category*
15.1	adjusted or conformed to price, price expectations or price changes
7.6	adjusted or conformed to income and/or debt repayment needs
52.9	responded or conformed to land and cropping patterns
57.0	responded or conformed to feed supply and/or livestock program
41.9	responded or conformed to government allotments and programs
9.9	responded or conformed to insect, disease, and/or weather conditions
8.7	responded or conformed to habit and custom
8.7	responded or conformed to labor limitations

Responses for six farmers were not ascertainable. Eight other less-used

of these questions was included on at least one of six different field questionnaires used in the survey. One question was included on two of the field questionnaires. These questions were open ended. Intensive probing was carried out by interviewers in connection with each question. The responses were recorded in detail on schedules, and analytical codes were developed to permit summarization and transfer of this detailed information to IBM cards.

The six field questionnaires were used in fixed order. Responses were received from 1075 farmers in eight strata located in seven states including Michigan, Indiana, Ohio, Kentucky, Kansas, Iowa and North Dakota. The sample for the study was random with respect to sample segments in geographic strata delimited within each state. The farmers sampled were those having primary entrepreneurial responsibilities for business units producing more than $2,500 worth of farm products, including the value of home consumption but excluding rental value of farm dwellings. Farmers with types of leases and partnership arrangements restricting their performance of the managerial functions were excluded.

For a more complete description of the nature of the IMS and an explanation of the universe of farms studied, see Harald R. Jensen, "The Nature of the Study," *Journal of Farm Economics*, Vol. 37, December 1955, pp. 1097-1102; and Cecil B. Haver, "The Universe of Farm Studied," *Journal of Farm Economics*. Vol. 37, December 1955, pp. 1102-1105.

categories accounted for 44 responses. Of the 17 categories considered, the 14 involving limitations on production accounted for 89 per cent of the ascertainable responses.[3]

The farmer responses were also classified on the basis of general approach to farm organization. Each farmer was placed in the category representing the approach which appeared to be dominant in the recorded responses. The results of this analysis follow.

Percentage of farmers	*General approach to farm organization*
45.0	land-use approach[4]
11.1	livestock approach[4]
17.0	combinations resolved by simultaneous solution
4.7	price expectations or outlook approach
6.4	all other methods of approach
15.8	method of approach is not ascertainable from the answer given
100.0	Total

About 85 per cent of the farmers appeared to have a general approach in mind which aided and directed them in making decisions concerning the organization of their farms. Most of the farmers relied heavily on approaches to farm organization which involved fitting a farm business organization to the characteristics of an important fixed asset such as land, livestock herd or supply of family labor without taking into detailed account interactions with other variables in the situation. Forty-five per cent used the land use approach and 11 per cent used the livestock approach. Considerable reliance was also placed on variable factors influencing organization. About 5 per cent used the price expectation or outlook approach, while 17 per cent arrived at an organization by fitting together several elements of the business without following a fixed pattern (simultaneous solution).

The heavy emphasis of farmers on the fixed elements in their business does much to account for *both* the usefulness and shortcomings of static production economic theory in explaining the individual and aggregative production behavior of farmers. The law of diminishing returns, so crucial to marginal analysis, does not operate except when variable factors of production are used in connection with a set of fixed factors. The heavy emphasis of farmers on fixed asset approaches indicates they find in their experience that this condition for using static marginal analysis is met; this accounts, in part, for the success of farm organization and price

[3] Other response categories indicating limitations on production not mentioned above include individual or family preference 2.9 per cent, specialty conditions 1.2 per cent, equipment and operating capital 4.7 per cent, experience and knowledge 5.2 per cent and buildings, fences, tiles, etc., 3.5 per cent.

[4] See L. A. Bradford and Glenn L. Johnson, *Farm Management Analysis*, pp. 98, 74 for a discussion of these approaches.

analysis work which are based on static production economic theory. At the same time, however, the major role which fixed asset approaches play in farmer behavior also accounts for the success of farm management analyses which ignore the interactions among variables which are handled by the marginal apparatus.

Farmer Responses to Changing Prices

In an attempt to learn more about the decision making processes of farmers, the consequent effect of these decisions on production (supply responses), and the consistency of these decisions with static economic theory, two unstructured question sequences were used. One dealt with responses to changes in input prices. The other dealt with responses to changes in product prices.

Changes in input prices. In the sequence investigating responses to changes in input prices, 184 farmers were asked: "What important thing that you buy (x) and use in production has had a fairly big change in price recently? What do you use it for? (y) How did you make up your mind about how much of (x) to use in producing (y) when the price of (x) changed?"

The data below present a breakdown of the explicit or inferred responses of the 163 farmers who answered this question.

Effect on production	*Change in input price* Increase	Decrease	Direction unknown
	— — — — — — —	number — — — — — — —	
Change in output or input use	45	9	6
No change	37	2	37
Not ascertainable	7	1	19
	— — — — — — —	per cent — — — — — — —	
Percentage of respondents in each input price situation	54.6	7.4	38.0

Ninety-three farmers (51 per cent of those responding) reported (1) how a specific input price had changed and (2) how this change had affected *their* production. Of an additional 37 farmers who did not state the direction of the input price change, 11, or 6.7 per cent, did not change production because, apparently, the input involved was a complement. Thus, enough information is available on about 64 per cent of the 163 farmers to appraise the consistency of their behavior with static theory.

Input price increases. Forty-five farmers experienced an increase in input price and *made a change* in their production. Seven reduced output, three did not reduce output but used more of a substitute, three did not reduce output but adopted cost reducing technology and/or practices, 12 did not indicate what happened to output but used more of a substitute, another 23 did not indicate what happened to production but adopted cost reducing technology and/or practices, while four increased output

and two went out of production. The four farmers who increased output did so with the aid of (1) cost reducing practices or new technology, (2) a more than offsetting increase in product price or (3) apparently felt that the new input price was still less than returns from its use. Some farmers gave more than one of the above reasons for their actions; only two of the 45 failed to give at least one reason consistent with static economic theory.

Thirty-seven farmers experienced an increase in input price, but made *no change* in production. Of these, 19 appeared to maintain unchanged production because they regarded the input as a complement, while 21 indicated that even though the input price increased, the price of the input was still less than returns obtained from its use. Two of the 37 gave no reasons for their behavior; one gave a reason which was neither inconsistent nor consistent with static theory.

Input price decreases. Of the nine farmers who changed production in response to a decrease in input prices, five actually decreased production because of a more than offsetting decline in product price, while three used more of the input with an unstated effect on output, and one maintained output but used more of the input as a substitute for other inputs.

Two farmers experienced decreases in input prices but made no change in production. Apparently, one farmer did so because the input, though still unprofitable, was less unprofitable than previously. The other farmer gave no reason for his decision.

General conclusions about responses to changes in input prices. Ninety-eight, 95 per cent, of the farmers on whom enough information was available concerning their responses to changes in input prices to appraise the consistency of their behavior with static theory behaved in manners consistent with that theory. The success of farm management and price analysts who base their work on static economic theory is not surprising; conversely, the importance of adjustments to changes in input prices emphasizes the inadequacy of approaches to farm management and price analysis which ignore responses to such changes. The reasons given by farmers for adjusting or not adjusting to changes in input prices indicate that while a majority experienced the changes from a near equilibrium position, many also experienced them from a position of disequilibrium, that is, the new prices occurred before some farmers were able to bring their businesses into the equilibrium positions resulting from prior changes.

Further, analysis of responses to input price changes shows that farmers are less responsive to increases in input prices than to declines. Forty-five per cent of these mentioning increases in input price did not change production, while only 18 per cent of those mentioning input price de-

creases did not change production.[5] The difference between these two percentages is significant at the 1.7 per cent level. The wording of the question permitted the responses to apply to both stock and flow inputs. If acquisition prices for all inputs equaled their salvage values, as is commonly assumed in static economic theory, farmers would be expected to be as responsive to rising as to falling input prices.[6] However, a difference between acquisition and salvage prices would make farmers less responsive to input price increases than to declines particularly for stock inputs following periods of expanded production. As the IMS survey was conducted in 1954, following several years of expanding production, and the study indicates that farmers were more responsive to price declines, it appears that the usefulness of static production economic theory might be enhanced materially by reconstructing more of it on the assumption that acquisition costs and salvage values differ for inputs. However, it should be pointed out that the question was not asked nor the responses coded in such a way as to permit detailed investigation of whether the respondents were "stuck with" supplies of inputs.

Theoretically, greater responsivity of farmers to input price declines than to increases suggests irreversible industry supply curves. Perhaps greater use of models in supply and price analyses which take differences between acquisition costs and salvage values into account would increase the proportion of *aggregative* supply behavior explained by such analyses.

Offsetting movements of product prices were common enough to indicate that the problem of isolating or identifying the separate influence of changes in input prices would be important in analyzing responses to price changes. This problem of identification has been important in both professional and lay thinking about the responsivity of farmers to price changes.[7] Probably many of those who reject static economic theory as contrary to observed responses of farmers to price changes do so without having first solved the identification problem.

Changes in Product Prices

The sequence of questions dealing with changes in product prices was presented to 178 farmers. It asked: "What important thing that you produce for sale (x) has had a rather drastic change in price recently? Did the price go up or down? How did you make up your mind about what to do about production of (x) as a result?"

In response to the first question of this sequence, 144 of the 178 farmers

[5] Glenn L. Johnson and Lowell S. Hardin, *Economics of Forage Evaluation*, North Central Regional Publication No. 40, April 1955, pp. 6-12.

[6] *Ibid.*

[7] See E. J. Working, "What do Statistical Demand Curves Show?" *Quarterly Journal of Farm Economics*, Vol. 41, 1927, pp. 212f, and Trygve Haavlmo, "The Probability Approach in Econometrics," *Econometrica*, Vol. 12, Supplement July 1944.

named livestock products and 27 named crops as having had a change in price recently. Almost 85 per cent of the farmers reported price declines since the survey was conducted in 1954. The small number of farmers reporting increases in product prices reduced the statistical significance of some empirical findings of this study. Eight farmers (4.5 per cent) did not indicate the direction of the output price change they had experienced. The third question in the sequence revealed the effect of changes in product prices on production.

Effect on Production	*Change in output price*		
	Increase	*Decrease*	*Nonascertainable*
Increase	6	13	0
Decrease	0	27	0
No change in level but a change in marketing process	1	26	0
No change at all	11	75	1
Nonascertainable	1	10	7

Of the 178 farmers questioned, 159 (90 per cent) indicated how a change in output prices had affected production. Seventy-three (41 per cent) changed production when output price changed, seven in response to output price increases and 66 in response to decreases. Eighty-six farmers (48 per cent of the 178) did not change production although they reported changes in output price: 11 of the 86 experienced output price increases while 75 experienced decreases.

This same group of 178 farmers gave 179 reasons justifying their action or inaction with regard to production. An analysis of these reasons shows

REASONS GIVEN FOR BEHAVIOR

Price and production behavior	Reasons consistent with static production economic theory					Reasons not covered by static production economic theory			
	Changes in price	Alternatives, relative prices	Lower cost structure	Marginal cost = New price	Fixed factors	Personal preference	Differing price expectations	Risk	All others
INCREASE IN PRICE									
Increase in production	4	2							
No change in level of production					3	1	6	3	1
No change in level of production but in production and/or marketing process			1						
Decrease in production									
DECREASE IN PRICE									
Decrease in production	25	8			3	2			
Increase in production		2	4	3			2		2
No change in level of production			3	—49—		10	28	12	5

that over 50 per cent of the observed behavior was consistent or, at least, was not inconsistent with static economic theory.

Six farmers increased production in response to higher product prices, while 36 decreased production in response to lower product prices for reasons consistent with static theory. Although no farmer reported decreasing production in response to higher prices, nine reported increasing production in response to lower prices for reasons consistent with static theory. These reasons included expansion as the best alternative, more-than-offsetting reductions in costs and correction of previous maladjustments. Only three farmers reported making no change in the level of production with an increase in product price. Fifty-two farmers gave reasons consistent with static theory for no change in production when product price decreased. Of these 52 farmers, eight lacked alternatives or experienced lower cost structures. A large group of farmers (49 in all) did not adjust production in the face of falling product prices for reasons apparently consistent with the hypothesis that marginal costs were still below or equal to the newly reduced prices or that fixed elements in their situation prevented adjustments. This situation tends to arise when farms are in disequilibria prior to the price change and/or when important proportions of the factors of production are fixed. The large number of farmers in this group therefore suggests that static theory used *comparatively* in essentially dynamic situations should be expected to be both relevant and productive of useful results.

A statistical comparison of the percentage of farmers who increased production in response to an increase in output price with the percentage who decreased production in response to a decrease in output price was significant at the 12 per cent level. The direction of the difference is consistent with the implications of fixed asset theory. The fairly unsatisfactory level of significance may be due primarily to the small sample of farmers experiencing increases in product prices, though of course this cannot be substantiated empirically.

In view of the greater responsivity of farmers to product price increases than to decreases, the more usual forms of static theory modified to take into account differences between acquisition and salvage values (and hence fixed assets) should be useful. These two suggested improvements in the use of static theory are of potential importance in the fields of farm management, supply and price analysis and in the analysis of policy problems.

The consistency with static economic theory of the reasons given for making or not making changes in production in response to product price changes indicates, as did the analysis of responses to changes in input prices, that analysts basing studies of operational problems on this theory should be relatively if not completely successful.

The importance of dynamic considerations was revealed by 36 farmers who held price expectations that were different from the new output price and 15 who made no change in production with a change in output price because of the risk involved.

Some Conclusions About Organizational Behavior and Responses to Price Changes

An over-all consideration of the data obtained from the three questions discussed above indicates that fixed assets are relied upon more heavily in the organizing than in the operating of farm businesses. The questions on adjusting to price changes dealt mainly with day to day operation of the business, and the question dealing with products produced dealt with organization of the business. Thus, there is evidence that consideration of fixed assets would aid analyses based on static theory; at the aggregative level, the consequence of this same evidence is that considerable attention should be given to irreversible supply responses in making supply and price analyses. It is also clear that many responses to price changes occur under initial conditions of disequilibrium and that modification of static theory to take this situation into account is desirable. The data obtained also seem to indicate a need to modify static analysis to include elements of dynamic economic theory, especially those elements which would predict behavior involving risk, the establishment of price expectations and adjustments to changing price expectations.

Managerial Behavior of Farmers in Connection With Machinery Purchases

In the IMS, 363 farmers were asked, "What was the last major piece of machinery that you bought?" Secondly they were asked, "How did you go about making up your mind to buy it?" Intensive probing was carried out by interviewers in connection with the second question.

Of the 361 farmers who answered this question, 298 indicated in their recorded responses that the purchase was made in response to a problem which they expressed as a need. One hundred ten also expressed the problem as a difference between a concept of reality and a concept of what ought to be (objective, goal or value). In addition to such complete statements of the problem they faced, 17 farmers expressed elements of the problem in terms of concepts of what ought to be but did not state concepts of reality. Another 120 farmers expressed concepts of reality but did not express a concept of what ought to be. Regardless of how completely they described their machinery purchasing problem, 303 of 361 farmers indicated that they postponed the decision to purchase in order to learn more about the situation.

Learning involves observation. Of the 361 farmers, 164 indicated that new observation was involved in the process of deciding to make the purchase and only two farmers stated that they did not use any new information. What the remainder did was not ascertainable. Of the farmers using new information, 94 used price information, 58 production, 37 human, 15 institutional, and only two used information on new developments. The kind of new information used by 15 was not ascertainable. Seventy per cent of 101 responses of 92 farmers indicated that the source of their new information was dealers and/or salesmen. The interviewers did not succeed in ascertaining the sources of new information used by 72 of the 164 farmers.

Ninety-three farmers indicated that old information was drawn upon in making their machinery purchase decisions. Of these farmers, 29 indicated this to be price, 43 production, 23 human and 10 institutional information. The kind of old information used by 12 respondents was not ascertainable.

Of the 361 farmers responding, it was possible to recognize clear evidence of analysis in 324 cases. There was frequent (214 times) evidence of substitute analysis involving inputs, complementary analysis (72 times) involving inputs, and profitability analysis (73 times).

The responses of the 324 farmers mentioned above revealed only 11 cases where *only inductive* reasoning appeared to have been used. The same responses revealed 93 cases where *only deductive* reasoning appeared to have been used. Some farmers reported more than one of these. By contrast, 142 farmers appeared to use combinations of inductive and deductive reasoning. The type of reasoning was uncertain or indeterminate in 82 cases. In 37 instances, there was no clear evidence of analysis. Among the deductive systems used, crude forms of static marginal analysis were important.

In their work on decision making, Johnson and Haver have listed five knowledge situations: subjective certainty or apparently perfect knowledge, risk-action, inaction, learning, and forced action situations.[8] On the basis of this classification, three farmers conceived the final decision to purchase as a perfect knowledge situation, 32 as a risk-action situation with insurance strategies, 56 as a risk-action situation with no evidence of insurance strategies, and three as forced action situations. Since a response to this question required that action had been taken, the *final* purchase could not be conceived as falling in the inaction or learning

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[8] See Glenn L. Johnson, "Learning Processes," *Proceedings of Research Conference on Risk and Uncertainty in Agriculture,* N. Dakota Agr. Expt. Sta. Bul. 400, August 1955, pp. 64-65, for geometric explanations of the concepts presented earlier in cooperation with C. B. Haver.

situation. However, the 303 farmers who had postponed the decision earlier in order to learn had been in the learning situation prior to the final decision.

An over-all evaluation of farmer responses to this question indicates (1) that crude forms of static marginal analysis play important roles in the analytical processes of managers and hence are capable of contributing to our understanding of and ability to predict managerial behavior *but* (2) that much of managerial behavior reported simply is not covered by static theory. Further, the evaluation indicates that the principles and classifications developed by Johnson and Haver have some important empirical counterparts in the behavior reported by farm managers in response to open-ended, nonstructured questions.

Conclusions

This analysis of responses to four behavioral questions of the IMS makes possible certain conclusions concerning the usefulness, relevance and shortcomings of static economic theory applied to farm organization, farm operation, the management process and in aggregative supply and price analysis relevant to policy work.

At the micro or farm management level, static theory assuming *usual initial equilibrium conditions* appears to play a relatively minor role in farm organization. In the case of farm operation, however, it plays an important role which also has important consequences for supply studies and price analysis.

Similarly, static theory *assuming initial disequilibrium* conditions does not appear to be important in explaining farm organization; however, farm responses indicate such disequilibrium theory has considerable importance in explaining the operational decisions of farmers governing their responses to input and product price changes.

The relatively poorly developed aspects of static theory dealing with fixed assets appear very important in understanding the various approaches of farmers to the problem of farm organization. With respect to farm operation, the empirically significant tendency of the farmers surveyed to respond more readily to input price decreases than to increases may be explained in terms of fixed asset theory. Although not significant at less than the 11 per cent level, a corresponding tendency of farmers to respond more readily to product price increases than to product price decreases indicates that fixed asset theory may play an important role in predicting the responses of individual farmers to product price changes. Budgeting, marginal analysis and linear programming with their dependence on fixed assets appear useful though inadequate to the extent asset fixities are not determined endogenously.

Shortcomings of static theory, for purposes of predicting the response of farmers to price changes, also include the absence, in that theory, of attention to risk and differing price expectations. In this study the need for dynamic theory appeared more pronounced with respect to farm operation than organization. However, it was further apparent that only a small proportion of the behavior of farmers making purchases of major items of machinery is predictable from analyses based on static theory whether or not modified to include more attention to fixed assets. The need for dynamics appears more crucial in understanding managerial behavior than in predicting responses.

At other extremes it was also clear that systems of analysis not employing the marginal apparatus of static economic theory are capable of predicting many of the farm organizations and organizational procedures reported by farmers.

In the case of aggregative work it appears that nonmarginal analysis could have predicted the annual organizations of the farms involved and that the usual forms of marginal analysis would be moderately effective in explaining shorter run responses to changing product and factor prices. It also appears that the usual forms of static marginal analyses would explain substantially more aggregative responses if modified to take fixed asset theory into account. Still further, it appears that significant amounts of the variance in aggregate response behavior would remain unexplained by "fixed asset" forms of marginal analysis. Explanation of this "unexplained variance" appears to depend upon the *addition* of a theory of managerial behavior (under imperfect knowledge) *to* "fixed asset" forms of marginal analysis; this addition would, of course, involve aggregation of micro behavior into aggregate responses.

A SIMULTANEOUS SOLUTION FOR THE EXPONENTIAL YIELD EQUATION

D. B. IBACH AND S. W. MENDUM[1]
Agricultural Research Service, USDA

PROCEDURES recently developed permit reflection of all reported observations in a factorial experiment when the exponential function for economic analysis of a fertilizer production surface is used. Previous work has illustrated use of this equation for one independent variable.

[1] Grateful acknowledgment is extended to Glenn L. Burrows, formerly consultant in the Office of Statistical Clearance and Standards, Agricultural Marketing Service, United States Department of Agriculture, for assistance in outlining the work of refining graphic estimates of parameters, and for setting up the tests for goodness of fit.

Satisfactory graphic methods of finding parameters have been shown.[2] Exact values of the parameters for one independent variable can be determined when desired, by methods previously shown.[3] But all previous published work with the exponential equation has been limited to its use when parameters applicable to a nutrient were based on response at selected levels of the other nutrients. This paper presents methods for evaluating the parameters when all nutrients experimentally applied are free to vary.

Form of Exponential Equation Used

The form of the exponential function used here is $\hat{Y}=M(1-R^x)$. The calculated yield, $\hat{Y}$ is a function of the theoretical maximum yield, M, and 1.0 minus the ratio between successive increments in yield, R, raised to the power represented by the number of units of the independent variable, x. The constant ratio between successive increments in yield is always a decimal, less than 1.0.

The fertilizer input, x, consists of two parts: the part applied, and the part available in the soil, as estimated by the function. For nitrogen (N) the estimated quantity in the soil is referred to as n; the applied part as a. For phosphoric oxide, P_2O_5, the corresponding symbols are p and b; for potash, K_2O, they are k and c. For simplicity of expression, the symbols P and K are used here to denote P_2O_5 and K_2O.

The exponential yield curve approaches an asymptote, M, the theoretical maximum yield. The expression $1-R^x$, if multiplied by 100, represents the percentage of maximum yield predicted at the specified rate of application, or unit value of x. Use of the equation is greatly simplified by specifying the value of R and expressing x in units of the size associated with the specified value of R. A table of x and corresponding $1-R^x$ values when R is specified permits rapid calculations. As Spillman had prepared such a table in terms of $R=0.8$, this value was adopted in current work.[4] Thus $1-R^x$ becomes $1-.8^x$, the size of a unit of x being one of the parameters determined as a result of obtaining best fit to the data. There is no significance to the .8. It might as well have been any decimal fraction. Tabular values for $1-.8^x$ are to be found in references 2 and 4.

Graphic Solution for Parameters

As is demonstrated below, parameters M, A, and R, developed from the main effects of each nutrient, reflect the simultaneous solution for the exponential function. The main effect at any rate of application of a nutri-

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[2] Ibach, D. B., "A Graphic Method of Interpreting Response to Fertilizer." U. S. Dept. Agr. Handbook 93, 27 pp., illus. 1956; ——— and Mendum, S. W., "Determining Profitable Use of Fertilizers." U. S. Bur. Agr. Econ. F. M. 105, 70 pp., illus. 1953.

[3] Paschal, J. L., and French, B. L., "A Method of Economic Analysis Applied to Nitrogen Fertilizer Rate Experiments on Irrigated Corn." U. S. Dept. Agr. Tech. Bul. 1141, 73 pp., illus. 1956; Stevens, W. L. "Asymptotic Regression." *Biometrics* 7: 247–267, 1951.

[4] Spillman, W. J., "Use of the Exponential Yield in Fertilizer Experiments." U. S. Dept. Agr. Tech. Bul. 348, 66 pp., illus. 1933. Also op. cit. 2.

ent is the average of all yields in the experiment at that rate of that nutrient. Trial values obtained graphically provide the starting point. The graphic method utilizes standard yield curves, each drawn to a different horizontal scale so that variations in response determined by experimental conditions are reflected in the fit obtained. Reported yields are plotted on graph paper. Then, by the overlay process, two conditions are satisfied: (1) a position on one of the curves is found at which the algebraic sum of deviations is at a minimum; (2) the sum of the squared deviations resulting from such a fit is the smallest that can be attained on any standard curve.[5]

The theoretical maximum yield, M, is read directly at the point where the yield scale on the overlay coincides with 1.0 on the scale of $1-.8^x$ values (Fig. 1). Then the $1-.8^x$ value associated with any yield read from

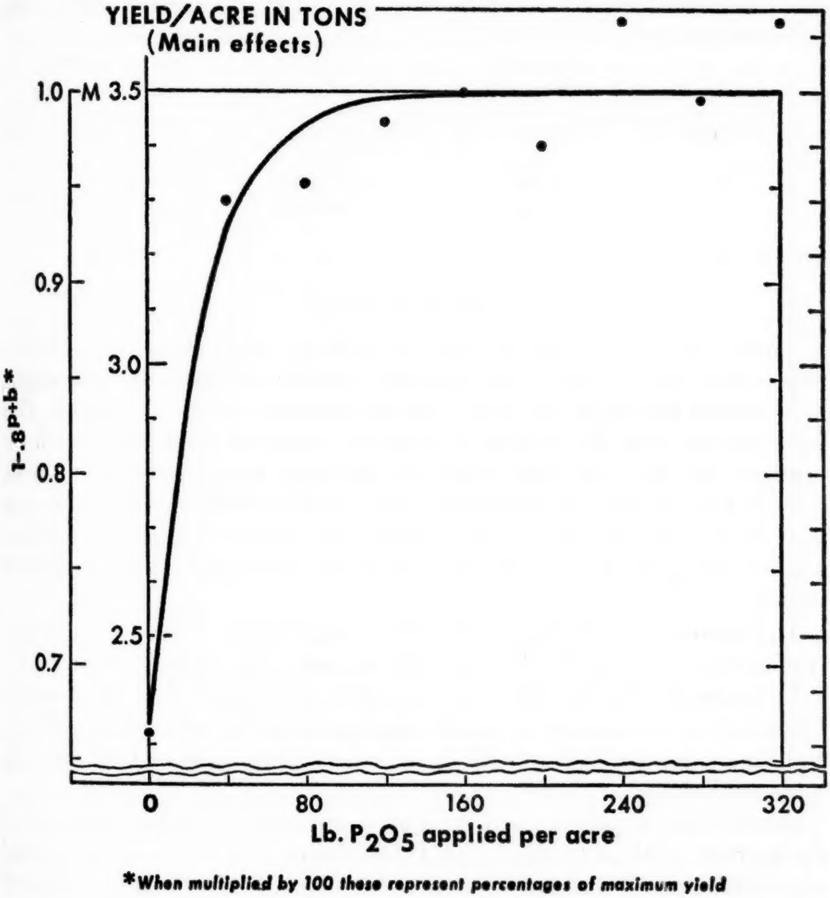

FIG. 1. GRAPHIC FIT OF ALFALFA YIELD RESPONSE TO P_2O_5 AT ALL LEVELS OF K_2O IN A FACTORIAL EXPERIMENT.

[5] See footnote 2.

the curve is derived as $\hat{Y}/M$. Thus at 0 application, if the nutrient involved is N, the expression is $1-.8^n$; if P, $1-.8^p$; if K, $1-.8^k$. The corresponding x value read from the table represents the number of units in the soil as estimated by the function. At any stated application of a, b, or c, $\hat{Y}/M = 1-.8^{n+a}$, $1-.8^{p+b}$, or $1-.8^{k+c}$. M on the N curve is referred to as M_N; on the P curve as M_P; on the K curve as M_K.

In using the standard curves based on $R=0.8$, the size of unit, u, is estimated after obtaining best graphic fit to the data. Thus the size of unit, rather than R, is left to be determined by the responses to the different applications. The size of unit associated with $R=0.8$ may be estimated through use of two readings from the curve. For example, based on curve readings taken from Figure 1, u_b, based on the main effects of P in a fertilizer rate experiment using 0 to 320 pounds each of P and K with alfalfa, may be calculated as:

b	$\hat{Y}$, read from curve	$1-.8^{p+b}$ when M_P is 3.50	$p+b$, read from table of values
(lbs./Acre)	(ton)	($\hat{Y}/M_P$)	(units of x)
80	3.438	0.982286	18.08
0	2.322	0.663429	4.88 $=p$
Difference 80	—	—	13.20

$$u_b = 80/13.20 = 6.06 \text{ lbs.}$$

Results based on different pairs of readings taken where curvature is sufficient to permit reasonably accurate graphic estimates of yield should be averaged to obtain the final graphic estimates of size of unit, u. This tends to minimize the chance of error as compared with placing full dependence on only one pair of graphic readings. Readings based on 0–40, 0–80 and 40–80 rates of application were used in obtaining the final value of u_b in this instance. When the results were averaged, and interpolations made in using the table of $1-.8^x$ values, the value of u_b becomes 6.06691 pounds.

The number of units represented by an application is derived as pounds applied divided by u. To this is added the unit value of the nutrient in the soil as estimated by the function, e.g., 4.88 units in the above illustration. The result is the x value to use in entering the table referred to earlier to find the proper multiplier for M in order to estimate the yield at the indicated application.

Figure 1 is a standard curve with an overlay on which has been plotted the average yields of alfalfa for all P treatments in a 9×9 partial factorial experiment with P and K.[6] Thus the plotted yields are the main effects of

[6] Heady, Earl O., Pesek, John T., and Brown, Wm. F., Crop Response Surfaces and Economic Optima in Fertilizer Use. Iowa Agr. Expt. Sta. Res. Bul. 424, 39 pp., illus. 1955.

P, or the average yields for different rates of P at all levels of K. Main effects of K are similarly plotted. As is shown later, graphic solution for the parameters for a production surface, when based on the main effects, results in a close approximation to the values reached in the complete simultaneous solution.

Graphic Estimate of Maximum Yield for the Surface

The maximum yield for the surface, which is referred to as M_{PK}, when P and K are the independent variables, for purposes of graphic analysis may be quickly found as $M_{PK}=Y/(1-.8^{p+b})(1-.8^{k+c})$ where Y is the average of all reported yields in the experiment,

$$1-.8^{p+b} \text{ is } Y/M_P \quad \text{and} \quad 1-.8^{k+c} \text{ is } Y/M_K$$

The average of all of the reported yields is 3.2969 tons; M_P is 3.500 and M_K 3.393 tons. Thus $1-.8^{p+b}$ is 0.941971, $1-.8^{k+c}$ is 0.971677, and the product of these two values is 0.915292. Thus M_{PK} is 3.2969/0.915292, or 3.6020 tons. When the maximum yield for the surface has been calculated, graphic estimates of yields at any combination of P and K are computed as $\hat{Y}=M_{PK}(1-.8^{p+b})(1-.8^{k+c})$.

Refinement of Graphic Estimates of Parameters

In refining the trial values for the simultaneous solution, preparatory to a test for goodness of fit, normal equations to be solved require that the value, R, be transformed from 0.8 with the unit of application determined as shown, to its value with the unit used in the experiment, in this instance, 40 pounds. It was found that $1-.8^{p+b}$ at 0 application is 0.663429. At no application, this is $1-.8^{p}$; therefore, $.8^{p}$ is 0.336571. The size of unit determined graphically associated with $R=0.8$ is 6.06691 pounds. Therefore, $40/6.06691=6.59314$ units of application for $R=0.8$ representing 40 pounds, the experimental unit.

As graphic determination showed 4.87999 units in the soil (interpolating in the table of $1-.8^{x}$ values), the level of $p+b$ at 40 pounds is 11.47313 units, for which the $1-.8^{p+b}$ value is 0.922706. Thus $.8^{p+b}$ at application of the first 40-pound unit is 0.077294. Then R, as graphically determined, in terms of a 40-pound unit is derived as 0.077294/0.336571, or 0.229651. This is the initial trial value of R^{b} for use in solving the normal equations for the complete solution.

The trial values for the phosphate regression $1-R^{p+b}$ are $(1-0.336571\,[0.229651^{b}])$, as determined graphically from the main effects of P. The corresponding trial values for the potash regression $1-R^{k+c}$ were found by similar means to be $(1-0.096350\,[0.625899^{c}])$. These values of $1-R^{p+b}$ and $1-R^{k+c}$ reflect the form of the yield equation, $\hat{Y}=M-AR^{x}$, used in writing the normal equations to be solved in finding correct values of the param-

eters. In this form of the equation, $A = M - \hat{Y}_0$, or the increase in yield attainable through adding fertilizer. In the normal equations, correct values of the parameters relating to each independent variable are found through successive adjustments of values beginning with those estimated graphically. With each successive adjustment, the approach to correctness is shown by term, dR, which indicates the error in the trial value of R used in that series of computations. A set of three normal equations is solved for each nutrient.

Starting with the trial value of R^b based on the graphic work, the normal equations for adjusting the value of R^b are:

$$1.\quad \sum (1 - R^{k+c})^2 M + \sum R^b(1 - R^{k+c})^2 A + \sum bR^{b-1}(1 - R^{k+c})^2 AdR = \sum Y(1 - R^{k+c})$$

$$2.\quad \sum R^b(1 - R^{k+c})^2 M + \sum R^{2b}(1 - R^{k+c})^2 A + \sum bR^{2b-1}(1 - R^{k+c})^2 AdR = \sum YR^b(1 - R^{k+c})$$

$$3.\quad \sum bR^{b-1}(1 - R^{k+c})^2 M + \sum bR^{2b-1}(1 - R^{k+c})^2 A + \sum b^2R^{2b-2}(1 - R^{k+c})^2 AdR = \sum YbR^{b-1}(1 - R^{k+c})$$

The more formal notation, using equation 1 as an example, is:

$$\sum_{b=0}^{8}\sum_{c=0}^{8} (1 - R^{k+c})^2 M + \sum_{b=0}^{8}\sum_{c=0}^{8} R^b(1 - R^{k+c})^2 A + \sum_{b=0}^{8}\sum_{c=0}^{8} bR^{b-1}(1 - R^{k+c})^2 AdR = \sum Y(1 - R^{k+c})$$

The important idea is that each coefficient of M is a single number, the sum of the 57 different products, each of which involves one of the 9 values of the phosphate function indicated in the 6 series $R^{b=0} = 1$, R^b, bR^{b-1}, R^{2b}, bR^{2b-1}, b^2R^{2b-2}, and one of the 9 values of $(1 - R^{k+c})$. The factors are best set down on cross-section paper for accumulating the products.

After completing this trial, which constitutes a first adjustment of the parameters for the P curve or phosphate function, these new parameters are worked into the series of weights, $(1 - R^{p+b})$ and $(1 - R^{p+b})^2$, for a first adjustment of the parameters of the potash curve, R^c, as they were obtained graphically, using the main effects of K.

These equations have been solved by dividing each by its coefficient of M, subtracting the second from the first and from the third, making two equations in A and AdR. Dividing each of these by its coefficient of A, the value of AdR appears. Then, by "back solution," A and M are determined, and the computations checked for accuracy through substitutions in equations 1, 2, and 3. Then, dividing AdR by A results in dR, the correction term for R. This process provides new values first for R^b and then for R^c,

which are used alternately in the normal equations as indicated above, until dR becomes an acceptably small fraction. The method leads to an exact solution, but soon the values reached for M, A, and R are changed so little that further iterations become unwarranted.

Next, a least-squares value of M for the production surface is derived as

$$M_{PK} = \frac{\sum Y(1 - .8^{p+b})(1 - .8^{k+c})}{\sum [(1 - .8^{p+b})(1 - .8^{k+c})]^2},$$

in which Y represents each reported yield and the $(1-.8^x)$ values are those associated with the corresponding nutrient levels. Yields are then calculated for all reported points on the surface. Residuals, e, are then computed as $Y-\hat{Y}$. These are used in testing acceptability of the parameters.

Testing for Goodness of Fit

At this point may be written the further equations satisfied when the parameters are adjusted:

$$\sum (eR^b(1 - R^{k+c})) = 0$$
$$\sum (ebR^{b-1}(1 - R^{k+c})) = 0$$
$$\sum (eR^c(1 - R^{p+b})) = 0$$
$$\sum (ecR^{c-1}(1 - R^{p+b})) = 0$$

These four equations provide our final test of goodness of fit; when the answer to each equation is zero, perfect fit is indicated. As in the case of the correction term dR resulting from solution of the three normal equations, some tolerance limits must be set. The smaller the value for dR resulting from the final iteration in solving the normal equations, the nearer to zero will be the result of each of the four equations testing goodness of fit.

Comparisons of Graphic with Complete Solution

This presentation has been in terms of a fertilizer rate experiment, in which P and K were used on alfalfa in a 9×9 partial factorial design. However, the same work has been done with reference to two other experiments of the same design, one including P and K on red clover, and one with N and P on corn. Rates per acre of each nutrient ranged from 0 to 320 pounds in each instance and the results indicated that the rates were carried to levels high enough to reach maximum yields attainable under the conditions. Table 1 presents comparisons between the graphic and the complete solutions as applied to the three experiments. No comparisons of results with those obtained from use of other functions in fitting a production surface are attempted here.

TABLE 1. SUMMARY OF RESULTS OF GRAPHIC AND COMPLETE SOLUTION FOR VALUES OF PARAMETERS OF THE EXPONENTIAL FUNCTION APPLIED TO THREE 9×9 PARTIAL FACTORIAL EXPERIMENTS

Item	Alfalfa		Red clover		Corn	
	Graphic solution	Complete solution	Graphic solution	Complete solution	Graphic solution	Complete solution
1. Sums of squares explained by regression	11.25	11.25	5.67	5.67	111827	112072
2. Σe^2	2.13	2.13	1.50	1.50	5087	4833
3. Coefficient of correlation	.91705	.91708	.88907	.88907	.97804	.98196
4. Satisfaction test equations						
$\Sigma eR^a(1-R^{p+b})$	—	—	—	—	−14.20	+0.01
$\Sigma eaR^{a-1}(1-R^{p+b})$	—	—	—	—	+33.10	−0.03
$\Sigma eR^b(1-R^{n+a})$	—	—	—	—	−15.52	+0.01
$\Sigma ebR^{b-1}(1-R^{n+a})$	—	—	—	—	+ 1.32	+0.54
$\Sigma eR^b(1-R^{k+c})$	−0.04	−0.00	−0.01	−0.03	—	—
$\Sigma ebR^{b-1}(1-R^{k+c})$	+0.00	+0.00	−0.02	−0.00	—	—
$\Sigma eR^c(1-R^{p+b})$	−0.12	+0.03	−0.02	−0.01	—	—
$\Sigma ecR^{c-1}(1-R^{p+b})$	−0.26	+0.00	+0.01	−0.01	—	—
5. M_{NP}	—	—	—	—	129.19	127.64
6. M_{PK}	3.60	3.61	3.74	3.76	—	—
7. R^a	—	—	—	—	.52055	.46545
8. R^b	.22965	.22364	.29507	.30062	.32772	.33382
9. R^c	.62590	.54222	.75279	.78598	—	—
10. Most profitable rate:						
N (pounds)	—	—	—	—	160	146
P (pounds)	49	50	40	39	132	135
K (pounds)	0	17	0	0	—	—
11. Yield at most profitable rate (tons; bushels)	3.09	3.16	3.20	3.13	119.48	118.93
12. Yield at no application (tons; bushels)	2.17	2.15	2.64	2.64	5.06	4.10
13. Increase in yield (tons; bushels)	0.92	1.01	0.56	0.49	114.42	114.83
14. Value of increase (dollars)	13.80	15.15	8.40	7.35	160.19	160.76
15. Cost of fertilizer (dollars)	4.90	6.02	4.00	3.90	38.80	36.86
16. Return to fertilizer (dollars)	8.90	9.13	4.40	3.45	121.39	123.90

Conclusion

Graphic determination of the parameters of the exponential yield curve as described is adequate for estimating yields for a production surface from responses indicated by the main effect of each of two or more nutrients in rate experiments. The practical sufficiency of the parameters graphically determined is demonstrated by comparisons with parameters reached by an iterative complete solution, the precision of which can be pushed through to any desired point. Noticeable differences in values of parameters and in results of satisfaction tests, in the case of the corn experiment, did not affect results that would be used as a basis for recommended fertilizer practice.

AN APPLICATION OF SCALOGRAM ANALYSIS IN AGRICULTURAL ECONOMICS RESEARCH*

ARTHUR D. JEFFREY
Cornell University

SCALOGRAM analysis is a mathematical scaling technique developed by Louis Guttman. It is used to rank the various members of a population with respect to some attitude area. An attitude is considered to contain only a single dimension. The universe under investigation is defined by a series of questions, the answers to which form a scale. This paper reports one application of this technique to an attitude problem in land use, specifically, the attitude of farmers in an area of submarginal land toward abandonment.

Basis for the Technique[1]

It is not the purpose of this paper to explain the mechanics of Guttman's "scalogram analysis", but a brief statement of the method is necessary to understand its application. The method consists primarily of ranking people in the order of their favorableness or unfavorableness toward an attitude universe of content.[2] The rank order must have a special cumulative property such that a diagram called a scalogram is formed. The diagram requires that persons who answer a given question favorably all have higher ranks on the scale than persons who answer the same question unfavorably. Such a scalogram is called a perfect scale because it has the property of perfect internal consistency. If the responses to a question do not meet this criterion, it is assumed that the question relates to another area of content or it means different things to different people.

The internal consistency is maximized in the sense of least squares. Each respondent in addition to receiving a rank order is given a numerical order or score and each item is given a numerical weight. In a perfect scale, the optimum score of a respondent is proportional to the arithmetic mean of the weights of the items which characterize the attitudes of that

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* This paper reports on one part of a doctoral dissertation submitted by the author to the Pennsylvania State University, January 1956. The suggestions and comments made by Professor John C. Frey while the work was in progress are gratefully acknowledged.

[1] An excellent review of the technique is found in an article by Philip J. McCarthy, "A Special Review of 'The American Soldier', Vol. IV." *Psychometrika*, Vol. 16, No. 3, September 1951.

[2] The aggregate of all of the questions which might be asked is termed by Guttman as the universe of content. Scale analysis cannot define content. It is assumed that the content universe is already defined by the questions which are asked. Thus a major criticism of the technique is that there is no way of knowing that the ranked items refer to the content area except by intuition.

person. These optimum scores have a linear relationship to the original rank order and have been shown to be the first principal component of an attitude.[3]

It was also found that after the most consistent solution, the underlying least squares measure just described, there is another set of values which gives a next best solution. This solution (the second principal component of an attitude) is a function of the second order which when plotted against the content scale forms a U or J shaped curve. The x values tend to be higher toward the zero and one hundred percentiles of the content scale and descend toward the middle.

The second best solution has been identified as the intensity of the attitude. The indexes of intensity have the property of locating the "zero point" or region of indifference on the underlying rank order of content. That is, intensity locates the point where the population shifts from favorable to unfavorable.

After the second best solution there is also a third best solution (the third principal component of an attitude) a third degree polynomial, which when plotted against the rank order yields a curve with two bends in it—an N shaped curve. There are at least two more principal components of an attitude which are progressively the fourth and fifth best solutions, but these do not concern us here.[4]

The third best solution or third principal component is called "closure." Psychologically, "closure" measures the decidedness of the population toward the whole attitude universe. In addition it has the unique property of permitting comparison among the possible subuniverses of an attitude. Thus there may be a number of scalable subuniverses, each with its own intensity function and zero point; all of these subuniverses may have the same third component, their common closure.

The empirical findings of Guttman and others indicate that if an attitude is scalable, the questions in the scale will have a high degree of

[3] Assume that the respondents have a frequency distribution of x values and that the variance of the entire distribution is σ_x^2. With questions dichotomized into "yes" and "no" items, assuming mean values of $\bar{x}_1$ and $\bar{x}_2$ for each question, it is desirable to have the difference between the mean of the squares of these differences as large as possible compared to σ_x^2. The maximizing of the differences between subgroups is equivalent to the minimizing of differences within subgroups. Thus the term "least squares" is used for the process of minimizing the variance within the subgroups. For a perfect scale there is always one set of values which will best satisfy the equation. As the rank goes up so do the scores. A person who has a higher scale rank than another will then also have a higher x score. Thus, these scores will be a linear function of the weights assigned to each item. For a complete discussion see Louis Guttman, "The Principal Components of Scale Analysis", in Samuel A. Stouffer, et al., *Measurement and Prediction,* Chapter 9, Vol. IV of Studies in Social Psychology in World War II, Princeton University Press, 1950.

[4] In general, for "n" different types of items there will be "n" principal components.

reliability for drawing inferences from the sample to the population as a whole. Likewise, the sample of the questions themselves will have a high degree of reliability for all of the questions in the universe of content. A major test for reliability is the coefficient of reproducibility, wherein a coefficient of .90 is considered adequate for predictive purposes. In practice a perfect scale is never found, but a coefficient of reproducibility as high as 90 per cent appears to be a reasonable choice unless future research shows its inadquacy.

Alternatives to Scalogram Analysis

During the last few years many studies in agricultural economics have dealt with the "opinions" or "attitudes" of farmers in a wide range of areas. These studies have generally been made by designing a series of questions which a researcher thought referred to the problem. The weakness of data obtained in this manner is twofold. There is no test of the reliability or of the internal consistency of the questions and answers. Frequently, questions are asked which allow the respondent to answer in their own words (open end questions). The grouping of these responses then becomes arbitrary on the part of the analyst, i.e., the members of the population do not make the classification. On the other hand when yes or no responses are desired (closed end questions) the questions may be interrelated only in the mind of the researcher and may mean different things to different people. While an elaborate method of checking performance over a period of time is sometimes used, its predictive value is limited and in addition may be a slow, laborious process.

Attempts have been made in other disciplines to overcome the weaknesses inherent in an approach to attitude measurement which has no framework for its analysis. Numerous ranking techniques have been developed as one way to overcome these deficiencies. However, the ranking process in most of these alternatives is left to the discretion of the analyst or a group of judges. Scalogram analysis, which gives assurance of unidimensionality and a test of reliability, seemed to be conceptually the most rigorous alternative available for attitude studies. Also, the concept of principal components appeared to be the only means of testing the second objective of an attitude investigation as outlined below.

The major shortcoming of scalogram analysis has already been mentioned in a footnote. This is the assumption that the scale questions are valid for measuring the attitude under investigation. This problem is not one that is limited to this technique, however. Assumptions also must be made in correlation analysis that the independent variable or variables are logically related to the dependent variable.

Other problems which arise depend on the mechanics of forming a

scale. For example, if answers to a scale question are dichotomized in such a way that 10 per cent of the population is in one category and 90 per cent in the other category, a coefficient of reproducibility of 90 per cent will necessarily occur. Problems of this nature are well known and their recognition is a part of the proper use of the technique.

Application of the Technique

The scalogram technique was employed in a study of idle farm land in Potter county, Pennsylvania, in 1953. Justification for the attitude investigation was based on the premise that deviation from the norm of rational economic behavior might be found in the attitudes of people toward the abandonment of farm land from agricultural use. The two objectives of the attitude part of this investigation were (1) to determine whether people, in an area where the amount of land being farmed was decreasing, were favorably or unfavorably disposed toward retiring land from agricultural production, and (2) to test the hypothesis that persons who continue to farm land where it is not economically justified have a non-economic orientation toward land.

The economic analysis which was given major emphasis in the investigation indicated that the value of the product from an acre of much of the land in the area was insufficient to cover the ownership costs after annual operating costs were met.[5] Thus, the economic analysis supported the original hypothesis that some persons were remaining on the land for reasons other than economic ones.

The procedure used for the attitude analysis was as follows: first, the response items were ranked or scaled on content; second, the questions which were scaled on content were then used for the second component, intensity, and tested for scalability; third, the intensity scale was related to the content scale; fourth, the questions which measured the decidedness of the respondents (closure) were scaled; fifth, the closure scale was related to the content scale.

To scale the content questions, weights were assigned to each response item. These weights had previously been determined by the parallelogram arrangement of a pretest using the scalogram board. A total score for each respondent was then determined from the item weights. Respondents were ranked in order of these scores from high to low, with those who were more favorable toward abandonment having higher scores than those who were less favorable. It was not possible to form a scale considering all of

[5] Land ownership costs included positive costs such as taxes and opportunity cost and negative cost derived from oil and gas leases. Arthur D. Jeffrey, "An Economic Analysis of Idle Farm Land, Potter County, Pennsylvania, 1953." Unpublished Ph.D. thesis (The Pennsylvania State University, 1956).

the questions as one attitude universe. However, when the questions were separated into one set of questions concerning monetary gains or losses from idle land and into another set of questions which concerned noneconomic considerations such as personal likes or dislikes, family pressures and so forth, a scale formed for each set of questions.[6] The one scale was termed economic and the other noneconomic. Both of these scales had coefficients of reproducibility of 90 per cent.

For purposes of illustration one of these scales from the pretest is shown diagramatically, Scalogram 1.

SCALOGRAM NO. 1 PRETEST OF ATTITUDE TOWARD ABANDONMENT OF FARM LAND
ECONOMIC SUBUNIVERSE

(Coefficient of Reproducibility=.88)

Respondent Number	Respondent Order	Item Order: More Favorable						Less Favorable
		Question 7 Responses 5, 4	Question 6 Responses 4, 3, 2	Question 8 Response 3	Question 7 Responses 3, 2	Question 6 Response 1	Question 8 Responses 2, 1	Question 7 Response 1
25	25	x	x	x				
1	24	x	x	x				
9	23	x	x	x				
17	22	x	x	x				
16	21	x	x				x	
20	20	x				x	x	
10	19	x	x				x	
14	18	x	x				x	
12	17	x	x	x				
19	16		x	x	x			
18	15		x	x	x			
4	14		x	x	x			
21	13			x	x	x		
5	12			x	x	x		
11	11			x		x		x
2	10				x	x	x	
24	9	x				x	x	
3	8				x	x	x	
22	7		x		x		x	
23	6				x	x	x	
8	5				x	x	x	
6	4			x		x		x
13	3					x	x	x
7	2					x	x	x
15	1					x	x	x

The sample population used for the study consisted of 160 respondents and scaled similar to the pretest but with a coefficient of reproducibility of 90 per cent. Space limitations necessitated reproducing only the pretest and reducing the number of items.

To obtain the desired parallelogram arrangement of responses, some of the items were combined since the respondents were unable to differentiate between them. This combining process may be seen more clearly from a restatement of one of the questions and the alternative answers:

Question 7—Most of the idle land in this area is poor farm land.

(5) ____ Strongly agree

(4) ____ Agree

[6] While the questions were not originally designed as two subuniverses, the pretest indicated that the questions would fall into two groups, each of which would form a scale.

(3) ____ Undecided
(2) ____ Disagree
(1) ____ Strongly disagree

In the scalogram, answer categories 2, 3, and 4, 5, to question 7 were combined to form two items. A person who checked 4 or 5 thought that "poor land" was responsible for idle land, a person who checked 2 or 3 thought that poor land was less responsible and a person who checked item 1 thought that poor land was not essentially responsible for such idleness. This question illustrates one set of items which belongs to the content universe and by scaling (forming a parallelogram) conforms to the principle of least squares.

The analysis of the intensity of each subuniverse, economic and noneconomic, was made by assigning another set of values or weights to the response items in each of the content questions. Instead of the items having the rank order 5, 4, 3, 2, and 1 as shown in the question above, the same items were given the values 3, 2, 1, 2, and 3. This process of assigning different weights to the answer categories is known as the "foldover technique." It simplifies the procedure by eliminating a separate set of questions which would ask how strongly a person feels about his answer to each question. When the scores of all of the items obtained from this new weighting were related to the scores obtained from the rank order of content, the U shaped curve of the second component resulted. Figure 1 shows the result of this process for the economic scale. In the diagram the scores for both the rank order of content and the intensity rank are shown in percentiles. The percentile values were determined by calculating the mid-point for each content item and the median for each item of intensity.

In the figure above, a zero point for the rank order of content on the economic scale of attitude toward idle land showed that approximately 25 per cent of the sample population were favorable to the abandonment of idle land and 75 per cent were unfavorable. The zero point on the noneconomic scale (not shown) indicated that approximately 50 per cent of the same population were favorable to abandonment of land and 50 per cent were unfavorable.

The intensity analysis indicated, therefore, that 75 per cent of the total population did not consider economic considerations sufficient reason to allow land to become idle when questioned within an economic context. Further, 50 per cent of the total population did not consider reasons other than economic ones sufficient justification for land to fall into agricultural bends was formed. The results of this procedure for the economic scale are reasons or value orientations was dominant. A determination of the dominant value orientation necessitated the use of the third solution to the

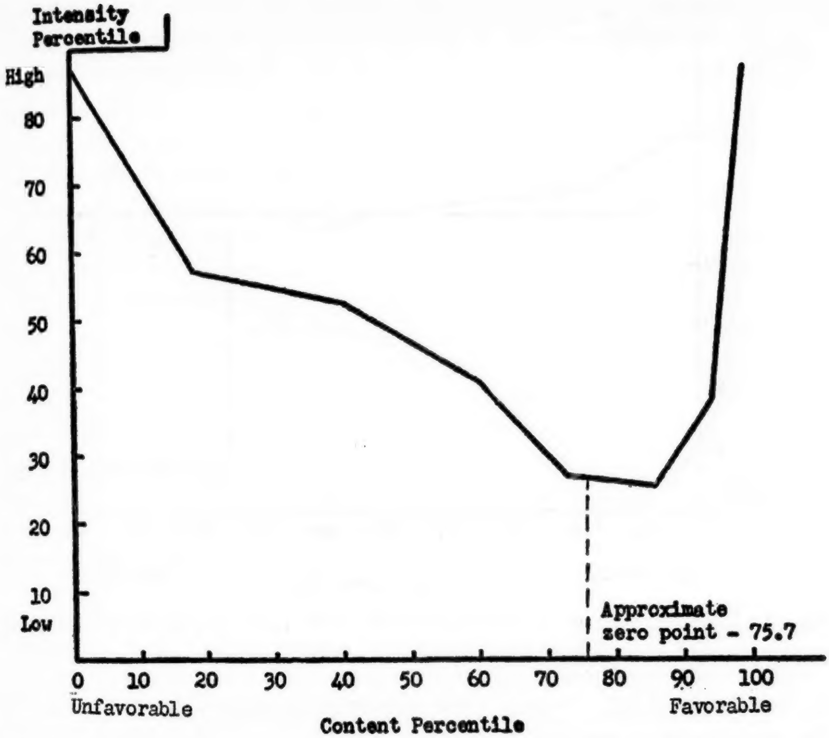

FIG. 1. ATTITUDE TOWARD ABANDONMENT OF FARM LAND, ECONOMIC ORIENTATION, 160 RESPONDENTS, POTTER COUNTY, 1953.

equations. One of the questions used to measure this component of an attitude was phrased as follows:

With some land going out of farming have you decided whether this is a good thing or a bad thing?

(4) ____ I think it is a very good thing to happen.
(3) ____ In some cases it is good but not in others.
(2) ____ I am not certain but I do not believe it is a good thing.
(1) ____ I am undecided as to whether it is good or bad.
(3) ____ In most cases it is bad.
(4) ____ I think it is always a very bad thing to happen.

The empirical scores obtained from the items of closure were plotted against each of the content scales. As predicted, in both cases a curve—admittedly crude because of the small number of respondents—with two bends was formed. The results of this procedure for the economic scale are illustrated in Figure 2. As was the case with the intensity component, the

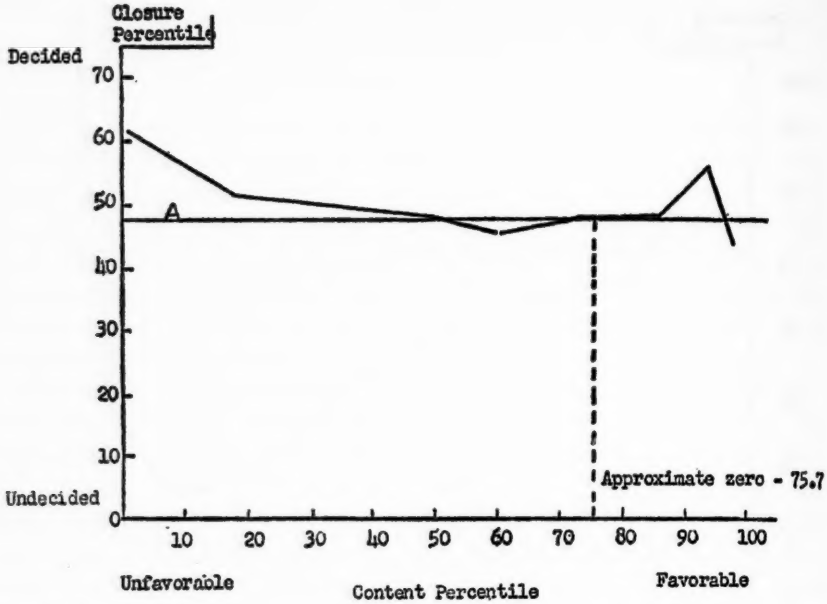

FIG. 2. ATTITUDE TOWARD ABANDONMENT OF FARM LAND, ECONOMIC ORIENTATION, 160 RESPONENTS, POTTER COUNTY, 1953.

scores obtained from closure were converted to percentiles and related to the rank order of content percentiles. Since "closure" has been described as a psychological metric which will make comparisons among the subuniverses of an attitude, the dominant subuniverse would be ascertained.

Consider the line A in Figure 2 which approximates the zero point of closure, i.e., a neutral point between decidedness and undecidedness toward abandonment. This line cuts the curve at approximately the 50 percentile, the 75 percentile and the 98 percentile. Those parts of the curve falling above the line are positive or decided in their attitudes and those below are negative or undecided in their attitude toward land abandonment.

Relating decidedness to the content axis to determine how definite people were in their attitude, it appeared that 50 per cent of the population were definitely decided against land abandonment, even though it was uneconomical. An additional 25 per cent were against land abandonment but were undecided as to whether it was for economic reasons. Twenty-three per cent were decided that land should be abandoned if it were not economically profitable. The remaining 2 per cent were in favor of land abandonment but could not distinguish as to whether economic factors were the only reason for their attitude.

The curve which resulted when closure was related to the noneconomic

content scale completed the analysis. This curve, which is not shown diagramatically, cut the zero line of closure at only one point—the 50 per cent mark on the content axis—and was positive throughout its length. Thus, 50 per cent were positive that they were unfavorable to land abandonment for noneconomic values and 50 per cent were positive that they were favorable to land abandonment for economic values.

Interpreting the results of the closure analysis of both the economic and noneconomic orientations it was found that in this locality approximately 50 per cent of the population were against the agricultural abandonment of land for noneconomic reasons, since they would not favor abandonment even if it were unprofitable to farm land; 25 per cent were undecided, although they would not favor farming land that was unprofitable; and approximately 25 per cent were favorable to land abandonment on economic grounds, i.e., if it were not profitable to farm. The dominant value orientation appeared to be noneconomic. Thus it was concluded (1) that a majority of the people living in an area of increasing land abandonment were against retiring land from agricultural use and (2) that this attitude was based on noneconomic considerations.

Conclusions

With respect to the use of the technique the following conclusions were made:

1. Scalogram analysis can be used effectively in attitude research in agricultural economics.
2. A population having an economic interest in agriculturally idle land, either because of residence or ownership, has a measurable attitude toward abandonment of farm land. Because of the homogeneity of such a population, meaningful results can be obtained with a relatively small sample.
3. Attitude toward land abandonment is scalable into at least two subuniverses, the one economic and the other noneconomic.
4. The intensity component can be used to establish the zero point or region of indifference for each scale and divides the population into favorable and unfavorable categories.
5. The third component or closure can be used to determine a dominant value orientation.
6. The problem of defining content is not solved by the technique and requires the same kind of logical reasoning necessary to correlation analysis.

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REVIEWS

Dry Farming in the Northern Great Plains, 1900-1925, Mary Wilma M. Hargreaves. Cambridge: Harvard University Press, 1957. Pp. xii, 587. $10.00.

To those who are particularly concerned with the problems of agriculture and the culture associated with it in a semi-arid environment, this is a work of first-rate importance. To appraise the problems of the present in their proper context, it is necessary to understand their origins and "how they got that way." This Mrs. Hargreaves' work does admirably. This work covers only the "settlement phase" of the dry-land farming movement on the Northern Plains, a phase generally ended by 1925. In a footnote, she says she is "now continuing research for a study on the subsequent history of dry-farming effort in this region." If she can delineate the factual content, organize the facts into meaningful patterns, and assess the significance of the patterns for the 32 years of violent change in dry-land agriculture in this area since 1925 as fully and revealingly as she has for the first 25 years, it will be the best study of regional agricultural development that the reviewer has come across.

The author has examined the significance of these factual patterns in explaining the development of the region, the origin of its problems, and its situation in the mid-twenties when its settlement phase came to a close. "The primary intent (of the book) has been to analyze the launching of agricultural settlement in the area. At the close of the period . . . (1925), this movement was virtually completed and its consequences were becoming apparent. That it had been promoted by a highly organized propaganda is the most obvious conclusion; that it had been an effort largely without over-all guidance in the public interest becomes equally apparent."

Mrs. Hargreaves also appraises the events and movements of the period within the climate of culture, knowledge, and opinion of the period. "Fundamental to the situation, however, was the fact that there had been little knowledge of what constituted the public interest. What is known of the region today was not indisputable in 1900. What is now known of national and local needs was not then established. The viewpoint with which men regarded the practicability of dry-land development rested heavily upon these uncertainties. Their genesis lay deep in the background of the nineteenth century."

Part II, entitled "The Dry-Farming Movement," is the heart of the study. (Part I is background and Part III contains chapters on development of the region and problems of settlement.) Part II consists of the following chapters: The Dry-Farming Propaganda: The General Movement; The Local Movement: Introduction Phase; The Local Movement:

Second Stage; Promotionalism and the Movement; Agricultural Science and the Dry-Farming Movement; National Land Policy: The Homestead Principle; and Other Programs of Land Disposition: The Sales Principle.

The chapter on Science and the Movement is interesting reading. An old saying has it that history never repeats. The evidence of this chapter belies the saying. Public research workers in agriculture are continually confronted with problems like those of our antecedents of 50 years ago. Today it is problems of agricultural policy, marketing, new crops or new uses for old crops, etc. for which the scientist is under pressure to provide immediate solutions whether or not he has the facts and knowledge. It is easy from the vantage of today to accuse the agricultural scientists of 50 years ago of not combating forcefully enough the blandishments of the dry-farming propaganda. However, "agricultural scientists, particularly those who were most inclined to restrain the dry-farming propaganda, lacked a positive alternative program. Moreover, the background of knowledge on which to rest such an approach had yet to be evolved. . . . More conservative agricultural scientists won a temporary victory in their efforts to control the propaganda through repudiation of Campbell's pretensions to novel procedural recommendations, but the vacuum in tillage guidance thus created merely opened the way for those who presented the more dangerous viewpoint that standard (humid, mid-western) farming systems were applicable to the region." Like many of our contemporaries, many of our illustrious predecessors rode the tiger of public pressures, didn't snobbishly snub him, but tried to guide him into less damaging channels.

The dry-farming movement was based on the following concepts: "first, that agricultural development of the semi-arid region was practicable as a normal expansion of the farming frontier—without thorough preliminary testing of the regional capacities, without adequate provision for educational guidance, and without modification of traditional policies of land disposition until after experience indicated the need; second, that such development served the general good—in terms of the State's desire for increased wealth and the National requirement for increased production; and third, . . . that regulation of promotional effort in accordance with planned land utilization was unnecessary and undesirable."

The reviewer considers the book to be "must" reading for all agriculturists who work in, are interested in, or grew up in any part of the Great Plains. Only one small criticism. The title can be misleading. It might imply a study of the evolution of dry-farming *techniques* in the Northern Great Plains. In fact, that was the reviewer's first impression. It would have been better titled, *The Dry-Farming Movement in the Northern Great Plains, 1900-1925.*

M. M. KELSO
Montana State College

The World Fertilizer Economy, Mirko Lamer. Stanford, California: Stanford University Press, 1957. Pp. xvi, 715. $12.50.

This voluminous research report is the latest in a series of studies on food, agriculture, and World War II by the Food Research Institute. Previous studies have been concerned with agriculture and food in the wartime economies of Japan, India, Australia and New Zealand, South Africa, Great Britain, the Danubian countries, and Western Europe. This study is concerned with one of the principal inputs to food production—fertilizer.

Dr. Lamer's statistical compilations are amazingly comprehensive. From them it is possible to determine the fertilizer use patterns of most countries, the flow of trade in fertilizer and fertilizer materials, yield responses to the application of various types and quantities of fertilizers, price histories and market structures (including the role of cartels), the marginal physical and marginal value product of particular fertilizers in selected countries for selected crops, and the effect of World War II on production, consumption and prices. The reader will find the discussion of fertilizers in Russian agriculture, the impact of wars on fertilizer production, and the future role of fertilizers in various economies of particular interest.

Agriculture has presented the Soviet Union's Central Planning Committee with its greatest challenge; a ruling bureaucracy with Sputniks in orbit and with serious plans for interplanetary transportation has been unable to raise grain output per hectare above 1909-13 levels. Lamer attributes this loss of the "grain battle" largely to fertilizer policies. The Soviet Union has concentrated its fertilizer program on cotton and sugar beets; both have registered increases—but unspectacular increases—in yields per hectare. It has relied on the exploitation of virgin land—the limit to which is now in sight—for its potato and grain yields. Inexplicably, while Khrushchev's "new" agricultural policy calls for many changes in the Soviet Union's staple food crops program, no mention is made of the possible role of fertilizer. Here is where Lamer leaves the problem. But the reader's appetite has just been whetted. Can the Kremlin planners win such an important economic and political victory simply by revising their fertilizer policies? If so, why have they not done so long ago? Lamer does not imply that Soviet leadership is so stupid, and that the solution is so simple, as such questions suggest, but his qualified answers to them would have enhanced the value of the chapter.

In time of war the demand for food and fiber increases, while the supplies of agricultural inputs are generally reduced: Labor resources are reallocated away from agriculture and into the armed services and

defense industries; phosphorus and nitrogen capacity is reallocated away from fertilizer production and into the manufacture of munitions. The restriction of agricultural output relative to demand raises the income of farmers; the postwar release of labor and fertilizer manufacturing capacity, and the decline in demand for agricultural output, reduces the income of farmers. Lamer's detailed documentation of this major disturbance and its aftermath should be required reading for Senate and House agricultural committee members. Whatever may be the merits and shortcomings of a parity price support program as a remedy for mild and temporary disequilibria in agriculture, it clearly cannot counteract cycles of such immense proportions as those generated by the last two wars.

Lamer's final chapter on fertilizers in the future is especially timely for those concerned with the problem of economic development. The underdeveloped nations of Asia and Africa must fight starvation by an increased use of fertilizers. Here Lamer correctly puts first things first: "Increasing food production by increasing the use of fertilizers seems often to be a better road to agricultural and national welfare in underdeveloped countries than building electric power plants, road, and machine industries, and relying on gifts of food from well-to-do countries" (p. 637). Lamer's prescription is not likely to appeal to the national pride of such nations, but in due time will very likely appeal to their reason.

These are only three of the many problems to which the study is addressed. The book is long on description and somewhat short on analysis. But as a descriptive study it is exceedingly complete and comprehensive. Those who wish to extend the analysis will find in Lamer's book a wealth of material with which to work.

JESSE W. MARKHAM

Princeton University

Introduction to Mathematical Economics, D. W. Bushaw and R. W. Clower. Homewood, Illinois: Irwin, 1957. Pp. xii, 345, $7.00.

The authors (an economist and a mathematician) provide an introduction to the use of mathematics in economic analysis. The reader is taught to work with functions, graphs, and equations; to differentiate and integrate; to use Taylor's Series, determinants, and matrices; and to solve differential equations and difference equations. These methods are used in an exposition of equilibrium and stability conditions in first isolated and then interrelated markets, and of the theory of the firm and the theory of the household.

The reader should know algebra at the second year high school level,

and economic analysis at the level of a rigorous senior course in college or first year graduate course in the theory of the firm and the theory of the household. He is introduced to the principal methods used in mathematical economics in such journals as *Econometrica.*

The book is divided into two parts. The first contains the mathematical economics; the second the mathematical tools used. At the beginning of each section in Part I there is a reference to the relevant part of Part II, which ought to be read before reading the section in Part I. In the mathematical section the authors have been unusually effective in anticipating and dealing with difficulties likely to endanger the reader's comprehension of the logic of the mathematics.

The authors think that the book will be useful primarily to graduate students and to economics teachers, and hope that parts of it may be used in some upper division courses. This latter hope may be a bit too optimistic, however. Undergraduates specializing only to the extent usual in American colleges are not likely to have learned enough economics to profit from Bushaw and Clower's book.

The book's greatest asset may be its worth to mature nonmathematical economists who have realized that mathematical knowledge multiplies analytical power, but have shrunk from the hardships associated with bringing their competence up to date. To such economists the book offers a chance to make a significant gain in effectiveness by the investment of a moderate number of hours of hard work. (Skimming is of no use in such a case; the reader must participate in the authors' work.) The discussion of general equilibrium is particularly interesting, and the presentation of difference equations should help an economist whose mathematical education was largely completed before the recent increase in emphasis on difference equations in economics.

In this connection it is significant that the book assumes a good knowledge of general literary and "graph-level" economics. While the mathematics used is relatively elementary, the economics is near the frontier of the discipline. To understand the use of mathematics in economics, the reader needs prior understanding of the general nature of the problems investigated.

The reviewer's only objections pertain to substance rather than exposition, and may be based on esthetic differences.

It seems that the authors' task has been complicated unnecessarily by their emphasis on the significance of combining stock and flow equations. Stock functions seem to be important only in explaining flow functions; dissatisfaction with one's stock of money is important only if one stands ready to take actions that will cause a flow of money to or from his stock. Bushaw and Clower obscure their models by restricting the use of flow functions to currently produced goods.

They depreciate unwisely the significance of the differences between atomistic competition models and other models. The analogy they establish for the two types is unimpressive; essentially they show only that in both types an unexpectedly strong demand in a given period tends to increase output in succeeding periods.

These objections are peripheral, however. The authors have worked effectively in pursuit of worthwhile objectives.

J. A. NORDIN

Iowa State College

Game Theory and Programming. A. W. Tucker. Stillwater: Department of Mathematics, The Oklahoma Agricultural and Mechanical College, 1955, Pp. 86. $2.00.

Game Theory and Programming is a paper-bound, miltilithed set of 13 lectures given by the author at the National Science Foundation Summer Mathematics Institute at the Oklahoma State University. The Institute was oriented to teachers of collegiate mathematics. Lectures 1 through 10 concentrate on game theory while lectures 11 through 13 concentrate on linear programming and its relation to game theory.

After extensively illustrating with simple examples such concepts as "matrix game," "pay-off matrix," "fair game," "optimal strategy," and "expected winnings," the author develops and proves basic mathematical theorems on linear inequalities and convex polyhedral sets in n dimensions that are then used to establish existence and duality theorems of matrix games and linear programming.

Perhaps it is appropriate at this point to indicate the sort of mathematical equipment needed to follow this development. At least some degree of familiarity with vector and matrix operations is necessary. Liberal use is also made of the geometric interpretation of vector and matrix operations. Two-dimensional graphs and three-dimensional isometric drawings are used to illustrate such concepts as "convex hull" and "polyhedral cone" and to support some of the steps in the proof of theorems. They are also used as graphic procedures to solve two- or three-row matrix games. Lacking this sort of a mathematical background, a potential reader would be well advised to consult such a text as *Introduction to Finite Mathematics*[1] which contains a section on vector and matrix algebra as well as a section on game theory.

For those equipped to follow the mathematical argument, the book contains a well-developed, clear exposition of the principal theorems of matrix games and linear programming. The author begins by proving certain general theorems about sets of linear equations and inequalities

[1] Kemeny, John G., J. Laurie Snell, and Gerald L. Thompson, *Introduction to Finite Mathematics*, New Jersey: Prentice-Hall, Inc., 1957, Pp. xi, 372.

that have been well known for many decades and leads gradually to more complex theorems that have only been published in the last few years. The author, by the way, is responsible for several of the more recent developments in this field. The emphasis throughout is on the proof of theorems, not on computational procedures.

There are only three references to economic application. In the introductory lectures, a simple example of duopoly is presented to illustrate "plural" games--games in which there is opportunity for the players to cooperate to their mutual benefit. Plural games are not further developed, but reference is made to publications and continuing work in this area. Linear programming is illustrated by simple examples of the transportation and feed-mix problems. In interpreting the somewhat artificial dual of the transportation problem, the author invokes ". . . the principle that something cannot be gained from nothing . . ." in order that the difference in prices between warehouse and market be no greater than the cost of transfer. Economists undoubtedly would have drawn a parallel between this requirement and the characteristics of a perfectly competitive market in space.

JAMES N. BOLES

University of California

Introduction to Finite Mathematics, J. G. Kemeny, J. L. Snell and G. L. Thompson. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1957. Pp. xi, 371. $5.00.

Finite Mathematics is a clearly-defined example of the new approach to teaching undergraduate mathematics. For some time now, college administrators have been introducing some of the content of modern mathematics early in the undergraduate curriculum. Other recent textbooks[1] have attempted this introduction by adding new topics to the conventional algebra, trigonometry, analytic geometry and calculus. Kemeny, Snell and Thompson, however, restrict themselves "to the consideration of finite problems, that is, problems which do not involve infinite sets, limiting processes, continuity, etc." (page v). By so doing, the authors find the fundamental ideas and theories of mathematics easier to state and prove. They are also able to cover basic topics in greater depth and to include many examples of the use of these modern techniques of mathematical analysis, especially in the social sciences.

The book opens with two chapters on logic. The first contains the elements of modern symbolic logic: connectives, compound statements,

[1] Good examples of these are C. B. Allendoerfer and C. O. Oakley, *Principles of Mathematics*, New York: McGraw-Hill Book Company, 1955, and J. E. Freund, *A Modern Introduction to Mathematics*, Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1956.

truth tables, logical possibilities, tree diagrams, logical relations and the validity of arguments. The second chapter approaches logic from the concept of the set, defining operations both symbolically and with the aid of Venn diagrams and relating these operations on sets to the connectives of compound statements. These introductory chapters provide the conceptual and operational base for a chapter on partitions, counting, permutations and multinomial theorems which in turn lead to a chapter on probability. This chapter includes a discussion of the problem of assigning probability measure, conditional probability, finite stochastic processes, the law of large numbers, and Markov chains. The next chapter deals with the operation and application of vectors and matrices. Then follows a discussion of the theory of linear programming and games along with the needed background in convex sets and maxima and minima of linear functions. The last chapter deals with further applications of mathematical processes in genetics, anthropology, psychology, sociology and economics. There is one section devoted to a simplified presentation of von Neumann's model of an economy expanding at a fixed rate but otherwise in equilibrium. The existence but nonuniqueness of the equilibria for such an economy is also demonstrated.

Each chapter contains an outline of selected reading. An attempt has been made to keep the amount of reading down by referring to pertinent chapters of other works and single articles rather than to whole books. At least one reference work for each major topic is usually included. In addition to a large number of worked-out examples, there is a set of exercises for each section graduated in difficulty with some hints and answers given. Some of these exercises contain results which are important for an understanding of succeeding sections. The novelty of example helps maintain interest and is rarely extreme. There are many helpful diagrams and only in the chapter on probability does notation become awkward.

Although nearly one-third of the sections in the first five chapters can be omitted to leave a core course in basic mathematics, it is the reviewer's opinion that the material covered will be heavy going for the average freshman. Except for the chapter on logic, the subject matter rapidly becomes complex while the exposition remains terse. It is also questionable whether freshmen can handle in a short period the great breadth of subject matter particularly when it is presented in an abstract fashion so early in their training. The authors do not share this view. They state that their book has been successfully tried in a freshman course at Dartmouth College, and they feel that the only prerequisite for it is the mathematical maturity obtained from two and a half years of high school mathematics. In the reviewer's experience, this will not be enough preparation. More

exposure to the analytic approach in other college courses and confidence in operating with college algebra and analytic geometry would be more realistic prerequisites.

Of more importance is the integration of modern mathematics into the college curriculum, the over-all choice of topics, and the place of *Finite Mathematics* in this changing curriculum. Few would dispute the inclusion of logic early in undergraduate training. But lower division mathematics already includes such courses as algebra, solid geometry, trigonometry, analytic geometry, and differential and integral calculus. Kemeny, Snell and Thompson add set theory, partitions, probability, vectors and matrices. Other new texts add, or at least deepen the discussion of, number systems, groups, fields, modern geometry, and fundamental stochastic processes. Now these courses cover a lot of territory and cannot possibly be absorbed by the end of the sophomore year, especially by those students who have been denied or, worse, allowed to avoid an adequate high school background.

For social scientists, and particularly for economists, the choice of topics may be easy. Nevertheless, this choice must be integrated into the general curriculum. It is certainly overdue for mathematics to be considered necessary for a wider range of students than just engineers and physical science majors. But on most campuses, curricula in mathematics for social science and for physical science will have to be joint in the early stages. Also, the shortage of teachers will be even more severe in these new topics which require greater maturity in the philosophy of mathematics than the usual student instructor of college algebra possesses. It is my feeling that a two-year program for all students should include introductions to logic, set, and number theory in the first semester, with elementary partitions, permutations, probability, and matrices in the second semester. These additions should be integrated into traditional courses of college algebra and trigonometry. Then, in the second year, a more thorough study of analytical goemetry and calculus should be built on this firmer base. The second year could carry the student as far as three-dimensional analytics, partial differentiation, and multiple integration and should include further new topics such as groups, fields, linear processes and games. This will probably require at least five lecture hours per semester. Special topics which are needed only for engineers or for physicists or even for economists could then be taught in separate specialty courses. Mathematics may thus come to be regarded as something more than a tool for bridge builders and atom smashers. For this ideal, *Finite Mathematics* would make an excellent *additional* text in the two first years and in the special courses for social science.

While this book is essentially for undergraduates, those of us who are

lacking in the modern approach to mathematics will find the book even more rewarding. In addition, many present-day graduate students in agricultural economics would benefit from a course taught from this book. The sections on applications important to economics, for example, are especially apt examples of the clarity of modern tools of analysis. Regardless of arguments concerning the proper scope, content, and timing of this new approach to mathematical training, this book achieves what to the reviewer is its major goal—a well-turned exposition of the spirit of modern mathematics.

E. J. R. BOOTH

Oklahoma State University

Introduction to Statistical Reasoning, Philip J. McCarthy. New York: McGraw-Hill Book Co., 1957. Pp. 402. $5.75.

The problem of what subject matter to cover in an introductory course in statistics is one which has puzzled many practicing and teaching statisticians. Judging from discussions that are so prevalent whenever statisticians gather, it can be assumed that this problem has not yet been solved. If we assume that an introductory statistics course will be primarily concerned with statistical inference, as opposed to descriptive statistics, we may consider three possible approaches in teaching this subject. These are: (1) a course dealing exclusively with the concepts of probability, (2) a "cookbook" course on some of the more elementary statistical methods, or (3) a general introduction to the concepts of statistics, with respect to planning and drawing inferences from a statistical investigation. None of these three approaches will accomplish all that is wanted. The first approach is likely to leave most students confused and wondering what good statistics are. The second approach leaves the students with the "cookbook" but not quite knowing what to cook. The third approach is possibly the best one, but on the other hand, it leaves the student with not very much that he can actually do with statistics.

In his book, *Introduction to Statistical Reasoning*, Philip McCarthy has, in general, taken the third approach. As the title indicates, the emphasis in the book is on the type of reasoning that is the basis of modern statistics. The book does a good job of this, and, in addition, illustrates this general approach with a collection of practical examples and a limited selection of methods.

The book may be divided into four more or less distinct sections: (1) an introduction into various aspects of a statistical investigation, (2) the usual chapters on the distribution of a variable (mean and variance), (3) an introduction to random sampling which leads into an introduction

to probability and the drawing of statistical inferences, and (4) some specific topics which include elements of sample design, χ^2 procedures and linear regression.

An attempt to cover thoroughly the entire contents of this book in one semester is, in the opinion of this writer, a rather formidable task. However, with appropriate cutting on the part of the instructor, a well-rounded presentation of the field of statistics to an essentially nonmathematical student may well be accomplished. However, this conclusion is based on the assumption that students will be able to master the necessary mathematics. Although the book is intended to be primarily nonmathematical, it is questionable that students in the social sciences, to whom McCarthy has addressed this book, possess even this much mathematical background and ability. Laboratory type sessions in conjunction with the course may well benefit these students.

This reviewer would like to make two suggestions that may improve the usefulness of the book. The first is that in the introduction, say chapter 2, a somewhat general statement is presented on the problem of drawing inferences from statistical investigations. This should not take too long, but would prepare the students for some of the material that is to follow. Secondly, as in many books of this kind, a heavy emphasis is placed upon the binomial distribution. Admittedly, this distribution affords a very good and easily illustrated example of the workings of probability, but one wonders whether the student may obtain a false impression of the practical importance of the binomial distribution. There may not, however, exist very good alternatives, with the exception of the use of sampling experiments which involve variables that are possibly more nearly normally distributed.

All in all, this reviewer recommends the use of this book in teaching an introductory statistics course to undergraduates in the social sciences, since it more nearly fulfills the need of covering modern statistical reasoning and techniques without involving students in too much complicated mathematics, and yet provides them with some basic ideas on statistical theory and methods.

RUDOLF J. FREUND

Virginia Polytechnic Institute

Farm Crisis, 1919-1923, James H. Shideler. Berkeley and Los Angeles: University of California Press, 1957. Pp. x, 345. $5.00.

Farm Crisis, 1919-1923, is the story of the "coming of age" of American agriculture. Perhaps to describe it more accurately, it is the story of agriculture in adolescence. It was an age in which agriculture was first experiencing all of the growing pains and insecurities of its new commer-

cialization—dependence on a world market over which it had no control, specialization and dependence upon price to give the farmer the goods he required for livelihood, growing capital and operating costs, and so on. It was a period in which agriculture aspired to share, as an adult partner, in the new middle class standard of living which the new technology was bringing to urban economic groups. It was the period in agriculture's growth in which it, at last, obtained full stature as a major economic class interest group. Agriculture became aware of its new political power, experimentally flexed its muscles in the political arena, and began to use its new found political strength to insist that government aid it in solving its new problems. Above all, for those who are seeking to develop an effective farm program today, it was the period in which agriculture, striking out myopically for answers to a production-price problem which it saw as short-term and emergency in nature, set the pattern and symbolism which today binds and confines a mature agriculture in its effort to find an effective long-term farm program.

The author presents a detailed and carefully documented chronology of the onset and steady worsening of the agricultural depression from 1919 through 1923. Step by step, Shideler relates how farmers, as their understanding of the nature of the price and production emergency grew, moved in their demands from reliance on self-help to insistence upon direct governmental economic intervention.

Believing that agriculture's price problems were largely the results of temporary maladjustments between production and demand, quite naturally farm leaders first counseled agriculture to rely on natural recovery, individual farm retrenchment, and orderly marketing through farm cooperatives. Subscribing also to the devil theory of causation as a further source of their economic woes, farmers attributed at least a part of their troubles to a conspiracy of middlemen and speculators. Consequently, they first sought government assistance for accomplishing such neo-Populist reforms as curbing monopoly and speculation and preventing marketing abuses by the railroads, the warehouses, and the processors of agricultural products. They also sought the time honored agrarian remedies of cheap credit, better credit facilities, and tariff reduction.

But as their reservoir of simple remedies for alleviating the economic crisis became exhausted, and farming, after three years, was still in the depths of depression, farmers began turning to positive governmental intervention to stabilize prices even at the cost of governmental control over acreage. "They were becoming willing to substitute security for free competition." Three years of economic adversity had brought farmers to McNary-Haugenism and a "new vision of positive national legislation to arrange economic affairs more justly."

Shideler demonstrates in his treatment of this early farm crisis that

the agricultural historian has a real contribution to make to the study of agricultural policy. For the student of agricultural policy, the greatest value of the story of the farm crisis of the early 1920's does not lie in the chronology of events. As a social historian, Shideler has presented the period as a sort of broad social laboratory in which the student can isolate and appraise the role of the various forces and agents whose interactions determined the course of public agricultural policy—the coercions of the new agricultural environment which drove masses of farmers to seek their security through government, the developing role of a new type of agricultural pressure group, the part played by visionary individuals preaching the gospel of an idea, the emergence of commodity groups struggling to come together in a Farm Bloc coalition, the behavior of the political parties, the presidency, the Department of Agriculture, and its expanding corps of economic experts, with their new statistical information which in itself became a coercion for government action.

Reading the history of past policy development also gives an appreciation for the slowness of the workings of democracy. The ways of democracy are not radical. New and different public policies cannot be expected to emerge full-grown from the minds of the public planner and find quick social and political acceptance. Rather, the public programs which find political acceptance are usually those which are built up eclectically out of old ideas, remedies, and proposals which have been in circulation long enough to have gained social respectability. Thus the New Deal agricultural program was not a radical departure from established patterns of thinking on farm relief. All of its pieces had had currency in the early twenties even before the days of McNary-Haugenism—price stabilization through government purchase, acreage reduction, and domestic allotment, commodity storage in government-owned warehouses and warehouse receipts as the basis for the extension of credit, the ever-normal granary, parity price, export subsidies, and so on. The ferment of farm discontent of the early twenties has been the idea reservoir out of which the agricultural programs of the thirties, forties, and fifties have been drawn.

From the historical perspective, then, the possibility of any very new or different comprehensive farm program suddenly emerging today and finding social and political acceptance seems remote. Perhaps agriculture must go through another of those periods of discontent and ferment in which new ideas incubate and slowly gain acceptance before a new and more effective program for solving the problems of agriculture can come into force.

W. ROBERT PARKS

University of Wisconsin

Economic Concentration and the Monopoly Problem, Edward S. Mason. Cambridge: Harvard University Press, 1957. Pp. XVI, 411. $6.00.

One may well doubt whether there is an English-reading professional economist who is not familiar with the Harvard Economic Studies. That distinguished series celebrated (in the words of the current editor, Professor J. K. Galbraith) "a double anniversary" in 1957 when the first half-century mark was reached and when the hundredth volume was published. The title of that volume, reviewed here, is relevant to one of the instructions (". . . no essay shall be considered which in any way advocates or defends . . . the restriction of commerce in times of peace by Legislation, except for moral or sanitary purposes . . .") of the David A. Wells bequest which over the years has been closely related with the Harvard Economic Studies.

Dean Mason's latest volume consists of reprints of his earlier writings, except for the General Introduction, the Introductions to the four parts, and Chapter 1 which is "A Review of Recent Literature" on the title of the book. Of the 18 chapters reprinted, about half were originally published in journals and proceedings and about half as chapters in books edited by and with contributions from others. The earliest writing goes back to 1936, although 13 of the chapters were written after World War II and nine since 1950.

The chapters are organized within four parts, each of which reflects the author's interests in research and public policy over the past two decades. Part I deals with "The Large Firm and the Structure of Industrial Markets"; Part II, with "Wage-Price Problems"; Part III, with "Raw Materials, Security, and Economic Growth" (subjects which are distantly related to the title of the volume but which reflect some of Mason's tangential interests and public service activities in the postwar years); and Part IV, "Antitrust Policy," returns to the main theme of the volume. Within each part, the chapters are arranged (with only two exceptions) in the time sequence in which they were written. Thus, the reader may note the extent to which there have been development and change in the author's thinking about Economic Concentration and the Monopoly Problem.

Of the various discussions by Mason, most agricultural economists are familiar with the views on agricultural resources and output set forth in The Report of the President's Materials Policy Commission of which he was a member. Reflecting the views of the Commission, Mason writes: "The projected increase in American requirements for agricultural products for 1975 as compared with consumption in 1950 is 40 per cent. . . . There is not much doubt that at existing price relationships, American agricultural output could increase over the next quarter century by much more than the projected 40 per cent" (November, 1952). Neither Mason

nor J. D. Black, who contributed to the Commission's study of agricultural resources, was shaken at all by such criticisms as those put forth by Colin Clark (see exchange between Clark in *The Review of Economics and Statistics,* August, 1954, and Black in *Journal of Farm Economics,* February, 1955). Yet, the outcome of the population-food race remains unresolved. (For a less positive view than the Commission's but more sanguine than Clark's, see Bressler's paper in the November, 1957, issue of *Journal of Farm Economics.*)

Another place where Mason directly touches a question familiar to agricultural economists is his discussion of price rigidity. "It is remarkable what economists, both in and out of government, and the representatives of various interest groups have been able to do with this concept. In the hands of the U. S. Department of Agriculture, it practically became the cornerstone of a theory of depression and one of the main justifications for price support of agricultural products. If industrial prices were as flexible as agricultural prices, the argument ran, industrial output would be as well maintained as is agricultural output. But if nothing can be done to make industrial prices more flexible, there is a strong case on both ethical and economic grounds for government support of agricultural prices." Mason's answer is, "All of these deductions seem to be highly dubious to say the least"—as he might have noted many agricultural economists in the outside government service have so long believed.

But Mason's volume is not intended to deal with agricultural policy. Agricultural economists should, however, find it a handy compilation of papers which struggle with significant issues facing the economy at large. As the national economy pulses in its growth, problems of concentration, competition, size, price flexibility, monopoly and antitrust policy, raw materials and economic development are of interest to agricultural economists as well as other specialists in economics. That the author does not convincingly resolve such issues, but rather thinks about and struggles with them, is indicative of the way mature and intellectually honest economists wrestle with difficult and possibly unsoluble problems.

Throughout the volume, Mason's discussions are public policy oriented whether dealing with the large-scale enterprise or raw materials. Neither an "institutionalist" nor a "pure theorist," and certainly not an "econometrician," he grasps at methodological support from various sources. Yet, he appears uncomfortably dissatisfied with the conceptual and empirical framework within which he is constrained. The inadequacies of available theories of monopolistic and imperfect competition ("a beautifully logical and consistent set of propositions without direct operational applicability"), the paucity and crudeness of data, and the admission "that valid generalizations usable as a basis for prediction or for public action in

their field are hard to come by" leave him without a firm foundation. He gropes toward his tentative and cautious conclusions more by instinct and professional wisdom than by rigorous analysis. Yet, the writing generates the feeling that the author "makes sense," without the reader being quite sure what are the explicit, logical, and empirical foundations of his argument.

The current status of Economic Concentration and the Monopoly Problem, from the view of economics, is well depicted in the volume. One may wonder why economists have progressed so little with those subjects during the past two decades. One reason perhaps is that there is not available a comprehensive, conceptual, and empirically substantiated framework to meet the needs of the times and within which monopoly issues and policies can be rationally and operationally formulated. But a corresponding lament may be chanted on the current status of economists' contribution to agricultural policy.

SIDNEY HOOS

University of California

Essays in the Theory of Economic Growth, Evsey D. Domar. New York: Oxford University Press, 1957. Pp. 1x, 272. $4.50.

This book is a welcome collection of some of Domar's brilliant articles, all but one of which have appeared in various journals over the past decade.[1] An uncomfortable proportion of recent compilations of previously published articles offer an uneven, disjointed and variegated fare for the reader. Not so with this book by Domar. As he tells us in the Foreword, the essays "have different titles and, at first glance, deal with different subjects, but they have a unifying theme and their logical structure is almost embarrassingly similar" (p. 3-4). In one sense it can be said that if the origin of modern growth theory is the publication of Harrod's "Essay in Dynamic Theory" (*Economic Journal*, March, 1939), then the subtitle of the present work could easily be: "Variations on a Theme by Harrod." Brahm's masterpiece consisted of eight variations and a finale; Domar's of a survey overture, seven variations, and a finale (previously unpublished) which is an analytical review of G. A. Fel'dman's article, "On the Theory of National Income Growth." All but this last essay contain a formal growth model analysis applied to some of the problems of advanced countries. This is not, therefore, a book on "economic development"; and while a nonmathematical economist *can*

[1] The most notable omission, the addition of which would have enhanced the usefulness of the book as a convenient collection of Domar's work is, "The Inter-relation between Capital and Output in the American Economy," in L. H. Dupriez (ed), *Economic Progress* (Louvain: Institute de Recherces Economiques et Sociales, 1955). Needless to add this is one of Domar's more inaccessible articles.

read it with profit, he should be ready to take on some pretty stiff "arithmetics."

One effect of the essays is to make clear the apparent paradoxes that abound in growth theory: the equality of full employment savings and investment is not sufficient to guarantee continued full employment of labor or capital (Ch. III); a rapidly growing debt may eventually comprise a smaller proportion of income than a more slowly growing debt (Ch. II); a country that continuously lends abroad need not eventually encounter an "import balance" if the rate of growth of lending exceeds the (average) rate of return on over-seas investment (Ch. VI); in a growing economy we cannot subtract depreciation from gross investment to ascertain net investment (gross investment less replacement), i.e., replacement falls far short of depreciation (Ch. VII). In a brief review we cannot follow Domar along all these interesting paths, so we shall concentrate upon what is the main theme—the development of a growth equation as a tool of growth analysis.

The early emphasis of growth theory, both in Domar and Harrod, was on the cyclical problem of unemployment. The attainment of a full employment level of national income is not sufficient to maintain a full employment equilibrium through time, since a positive saving ratio increases capacity as savings result in capital formation, but fails to increase the demand necessary to absorb the economy's enlarged production. As Domar so aptly puts it, *"an increase in income is not a function of the amount invested; it is the function of the increment of investment."* Thus the whole body of investment, so to speak, increases productive capacity, but only its very top—the increment—increases national income" (p. 98). A constant stream of investment, then, increases the supply aspects of income (capacity), but does not enlarge the demand for income. To achieve equilibrium between the supply and demand of income, income must grow.

The growth equation is introduced at this point to determine how rapidly income must grow to maintain full employment. On the supply side, the increment in capacity is equal to the volume of investment (I) divided by the marginal capital-output ratio (MKOR), or as Domar initially writes it, (I) multiplied by the reciprocal of MKOR (σ), i.e.,

(1) Δ capacity $= I\sigma$.

Given an increase in investment we obtain the increase in total effective demand (income) via the multiplier:

(2) $\Delta Y = \Delta I/\alpha'$, where α' is the marginal propensity to save.

If we start from a position of full employment, equilibrium requires that income and capacity both grow at the same rate so that:

(3) $\Delta I/\alpha' = I\sigma$.

Multiplying both sides of (3) by α' and dividing by I shows that the necessary rate of growth of investment is equal to $\alpha' \sigma$, or α'/MKOR. In setting out the equilibrium growth path of income and investment in this way, Domar assumes a constant MKOR and a marginal saving ratio (α') equal to the average (α). He then states that his object is to make income and capacity growth identical (p. 91). But 142 pages later (and some 10 years later in time), we are told that with a given MKOR the *average* saving function determines the growth of *income* and the *marginal* saving function determines the growth of *investment*. Obviously if we assume the marginal and average saving functions are equal then unless we postulate changes in sectoral MKORs, income and investment *must* grow at the identical rate of α/MKOR.[2] Notwithstanding this rigidity in his "equation analysis" of the equilibrium rate of growth, Domar in his discussion of "growth-generated-fluctuations" (Chs. III-VI), introduces variations in MKOR and in the concluding paper he examines, among other things, the implications of a divergence between α and α'.

In the final essay Domar gives a brilliant presentation of a growth model first offered by the Soviet economist, G. A. Fel'dman in the late 1920's. Fel'dman's model, which Domar expertly lays bare, operates with two MKORs (one for the capacity-increasing-goods sector, another for the consumption-goods sector), and a saving function somewhat different from the usual Keynesian one. Fel'dman used the fraction of total investent allocated to the "capacity-increasing" industries (γ), and Domar cleverly demonstrates that if the two sectoral MKORs are identical, then Fel'dman's γ is equal to the Keynesian α'. Under these conditions, if the marginal saving function is higher than the average, the rate of growth of investment will exceed the growth in income by a factor of α'/α. This finding provides a key to the puzzling phenomenon of how Russia's investment could grow so rapidly between 1928 and 1948 although their average saving function was quite small (pp. 236-239). With α' above α investment growth outspaces income growth but over time α will itself be raised (since α' is above it), so that the initial low income growth will rise and eventually (when $\alpha = \alpha'$) equal the rate of growth of investment (p. 232).

Fel'dman had high hopes of a secular falling MKOR and thus a steadily increasing rate of growth of income. As Domar points out (pp. 255-256), any desired growth rate can be achieved (in model building) by simply postulating high saving ratios and low (or falling) MKORs. Domar's criticism of the Russian model builder appears amply justified, and it may be well, in concluding this review, to repeat this criticism for the benefit

[2] When Ch. IV was originally published Domar assumed only the marginal saving function a constant, but in a paragraph rewritten for the book he says, "we shall now assume that the marginal and average propensities to save are equal . . ." (p. 91).

of the ever increasing group of Western economists who approach the problem of economic development largely in terms of models (pp. 256-257):

. . . almost any rate of growth could be derived on paper, provided the capital coefficients were low enough and the propensity to save (or γ) high enough. They certainly failed to realize that these parameters, and particularly the capital coefficients, were mere abstractions, useful (I trust) in theoretical work, but full of innumerable and well-hidden implications regarding the actual working of the economic mechanism, and that the whole problem of economic development lies not in the algebraic manipulations which Fel'dman carried out in such detail, but in overcoming the immense administrative, technological, and human obstacles which a rapid industrialization of a backward peasant economy was bound to create.

WILLIAM O. THWEATT

Vanderbilt University

The Economics of Under-Developed Countries, Peter T. Bauer and Basil S. Yamey. Chicago: The University of Chicago Press, 1957, Pp. xiii, 271. $2.25.

This volume is presented as a Cambridge Economic Handbook. This series is now under the joint Anglo American editorship of C. W. Guillebaud and Milton Friedman. In the introduction, the general editors state that their aim in the series is to bring to a wide audience ". . . lucid explanations and significant applications of 'that technique of thinking' which is the hallmark of economics as a science." Bauer and Yamey fulfill this aim rather well in the present volume.

The book is divided into two parts. Part I, "Descriptive and Analytical," contains an excellent discussion of problems of economic measurement and an examination of the general resources situation of underdeveloped countries, with a skillful use of empirical studies to provide illustrations of the principles discussed. Statistics are used sparingly, mainly because of the authors' conviction of the difficulties of numerical expression. In this section they are "concerned with what is or tends to be, rather than with what ought to be. . . ." They conclude convincingly that "occupational statistics are an infirm foundation for any generalization" about economic progress; that there is no standard demographic pattern by which one can identify underdeveloped countries; and that it is not possible to isolate capital formation, a heightened spirit of enterprise, improvements in production techniques or improvement in the qualities of labor as "the inevitable prime mover in the process of economic development and change."

The final conclusion (with which this reviewer heartily agrees) on the last page of the book is that economics provides no ideal pattern which can be applied directly to specific situations; the circumstances and po-

tentialities of each case must be examined, and the function of the economist is to ask relevant questions and point to the necessary or probable consequences of particular policies.

Part II of the book concerns the role of the government in promoting economic development. The authors state that they "... prefer a society in which policy is directed towards widening the effective range of alternatives open to members of that society." However, they often fall back on the more manageable (and more debatable—as they well recognize) criterion of increases in national income, as a basis for judging when economic improvement has occurred.

It is difficult to summarize the authors' conclusions on the proper role of government because they discuss a wide range of governmental activities and many of the conclusions involve qualifications depending upon local circumstances. However, they are skeptical of the usefulness of many of the things that governments these days are very prone to do. They believe that government properly has "... only a limited role as an active propulsive agent in economic development in the capacity of saver or entrepreneur, or as controller or director of the economic activities of others."

Although the book's treatment of the role of government is stimulating, and much of it is incontrovertible, it appears to this reviewer that the authors tend to use uncertainty to bolster their own position. When the effects of government action are seen to be quite uncertain, the authors seem to conclude very often that the action probably is unjustified. Of course one might defend a proposition that government action is bad unless proven good, but the authors have not specifically put this ingredient into their criterion.

In Part II in several places there is an unfortunate equating of "value" judgments with "political" judgments. The latter, (i.e. judgments about political situations) may be quite as objective as an economic analysis. Parenthetically, I wonder what will be the reaction of the politicians in underdeveloped countries who read here the suggestion that "... it is advisable to progress gradually in the development of the exchange economy." Some may feel that gradualness is an alternative they do not have.

The outstanding deficiency of the book is that there is practically no discussion of the experience of the Soviet Union or any of the communist countries. The authors recognize the deficiency but contend the analysis was not possible within the compass of this book. Perhaps they are right, but the omission results in a book which scarcely touches on some of the most vital issues relevant to its subject.

JOSEPH WILLETT

Alexandria, Virginia

International and Interregional Economics, Seymour E. Harris. New York: McGraw-Hill, 1957. Pp. xiv, 564. $7.00.

This is not a big book—as books go today, but its scope is panoramic. Harris, perhaps the most prolific writer among American economists, has brought within some 550 pages a remarkably comprehensive and well-balanced analysis of the problems of postwar economic adjustments, particularly those concerned with international relations. The author was not satisfied that an understanding of these problems could be provided within the framework of what is normally considered to be the province of international economics. Thus he gives a considerable part of the volume over to a review of general economic theory, of the theory of international trade, and of the bearing of fiscal and monetary theory and policy on the area of special concern. The volume stresses the danger of considering questions of international economics in anything but the broadest terms. Harris not only develops the relationships between the subject matter areas set out above, but places them in a context that reveals the flow of thought beginning with the British classical school and proceeding to the present time.

The breadth of the approach to his subject reflects the importance the author attaches to economists showing more concern with the dissemination beyond the walls of the universities of the important findings of their studies. Thus he aims the work at the intelligent well-informed adult, hoping it will compete with the "populizers without technical competence . . . and sometimes even charlatans (who) control too large a part of the market for economic ideas" (p. vii). It is very much to be hoped that Harris has not misjudged his audience. The reviewer feels that he may have, since the work includes several chapters which will surely represent tough going for nonspecialists. But the volume will be of the greatest use to agricultural economists who must be aware of the economics underlying current international economic adjustments, but who cannot be narrowly specialized in that area of study.

This very comprehensive work is divided into five parts. The *first* is an introduction to the problem and is concerned with the history of international trade theory in the classical and neo-classical periods. The *second* part considers the role of money, capital movements, and balance of payments in international trade problems. The *third* is a statement of the theory of regional economics. The *fourth,* bringing together the materials of the earlier portions of the work, considers in general terms the problems of economic adjustment. Finally, the *fifth* section treats with the problems of economic adjustment in the postwar world.

While part one is a review of appropriate theory from Adam Smith to Ohlin, some consideration is given to the contribution of recent workers

who have considered international trade under conditions of less than full employment and who have recognized limitations of factor mobility within as well as between countries. This later area becomes the center of the following chapters, emphasis being given to the radically changed role of monetary and fiscal policy. Whereas until recently the primary and frequently sole objective of monetary policy was in protecting the external balance of a country, objectives of expanding and stabilizing the internal economy have now become predominant. With the end of the gold standard, this instrument along with fiscal measures offers the widest opportunity to operate simultaneously on both the internal and external aspects of an economy. However, Harris emphasizes Keynes' warning that in such a world international cooperation is necessary to insure that pursuit of internal or domestic objectives by large countries does not injure other countries.

The chapter on regional economics will be of particular interest to agricultural economists. In large countries interregional far surpasses international trade in importance. Harris says little about the theory of location other than to stress the importance of institutional factors. However, much is said about "regional interrelations," about "regional variations in incomes," about "regional balance of payments problems," about "federal transfers," and about "regional problems of adjustment." Tribute is properly paid to the valuable regional input-output studies done by Leontief and Isard. The opportunity for the federal government to "control" regional expansion or contraction through Federal Reserve policy, through tax policy, through federal spending, and through such measures as minimum wage legislation are considered. These are richly illustrated in terms of the shift of the textile industry from New England to the South. That very wide regional differences in incomes persist despite federal policy and despite sweeping migrations of capital, management, and labor is clearly revealed.

Most readers will conclude that the development of a body of theory adequate to explain the dollar shortage remains on the economist's list of unfinished business. The whole consideration of the problem is beset by conflict. Harris devotes about 100 pages to this and closely related questions. He shows that from 1914 to 1953 "exports of goods and services of the United States exceeded imports by 125 billion dollars" (p. 324). He states "I believe that an attempt should be made to close the gap *primarily* through the United States' yielding of export markets in third countries and reliance on a generous lending and aid program by this country in the next 10 years at any rate rather than through liberalizing trade" (p. 325). The proposal regarding lending and aid is based on lengthy consideration of the economics of underdeveloped countries.

This well-written, if not especially well-organized book, is not controversial. It represents much more a review of an important area of thought than an author laboring any particular thesis. Its eclectic character is one of its greatest attractions.

DAVID L. MACFARLANE

McGill University

Capital in Agriculture: Its Formation and Financing Since 1870, Alvin S. Tostlebe, National Bureau of Economic Research. New York: Princeton University Press, 1957. Pp. xxvi, 232. $6.00.

This book reports the findings of a joint study by the Agricultural Research Service, U. S. Department of Agriculture, where the author was a member of the division of agricultural finance, and the National Bureau of Economic Research. The study is part of a larger investigation of trends and prospects in capital formation and financing in the principal capital-using sectors of the United States economy. The first monograph, Capital Formation in Residential Real Estate: Trends and Prospects, was published in 1956. Part of the findings incorporated in this book were previously reported in Occasional Paper No. 44, The Growth of Physical Capital in Agriculture, 1870-1950, National Bureau of Economic Research, 1954.

For 10 major agricultural regions of the United States, the author examines trends from 1870 to 1950 in: (1) relationships between the increase in capital and number of persons in agriculture which combined to produce a rapidly rising agricultural output; (2) shifts in the physical composition of capital in agriculture; and (3) the relative importance of various sources of financing. Tostlebe brings together a wealth of basic data not heretofore available, especially in comparable series and in such continuous detail as in this volume. Researchers and students studying capital problems and trends in American agriculture will find this volume an invaluable source book.

In individual chapters the author examines: (1) basic agricultural developments accompanying growth of capital; (2) the value of physical capital in agriculture; (3) financial assets of farmers; (4) physical capital per farm and per person engaged in farming; (5) the relation of capital to product; and (6) sources of farm capital. Development of basic data from many sources into comparable series, especially prior to 1910, was a major accomplishment in itself. The methods used and the limitations of the estimates finally made are explicitly stated in each instance. In addition, a series of appendices are included, presenting detailed statements of the exact methods used for making various estimates and deriving various types of basic data.

During the period of 1870-1910 labor and capital added to the agricultural plant were of a proportional magnitude and only somewhat smaller than the increase in agricultural output. During the period 1910-1950 technological progress made possible much greater output with greatly reduced quantities of labor and only a slightly larger physical stock of capital. The rate of increase in productivity per unit of input of resources is quantified in aggregate terms for agriculture and illustrates vividly the effects of the technological revolution now underway.

Trends that the author foresees with respect to capital formation and financing include: (1) continued increase of farm output per unit of capital; (2) continued increase in capital per farm and per person engaged in farming; (3) aggregate capital growth in agriculture only in times of reasonable prosperity and at an average rate of less than 1 per cent per annum; (4) continued change in the composition of farm capital—more machinery, livestock, and cash relative to land, buildings, and stored crops; (5) the bulk of the funds required for continued aggregate increases in total capital to come largely from gross farm income; and (6) continued increase in importance of non-real-estate credit relative to long-term mortgage credit from lending institutions.

The source of gross funds for replacement and additions to physical capital and working cash is one of the interesting and important findings of the study. "Internal" financing, largely from gross farm income, was the major source and exceeded 70 per cent in every decade except one since 1900. More importantly, a trend toward more internal financing continues, totaling over 90 per cent for the 1940-49 decade. The great bulk of our teaching, research, and extension activities in the field of farm finance is directed to sources, procedures, and techniques of agricultural credit and lending institutions. Our activity has been concentrated on the external sources which provide only 10-20 per cent of the total funds for maintaining and increasing the capital plant in agriculture. The findings of this study are sufficiently significant that we could well afford to reevaluate our emphasis in the farm capital picture. Certainly, greatly increased emphasis needs to be given to the internal financing of the agricultural plant.

Some economists would be uneasy about the estimates and trends derived from fragmentary data; statisticians would in places suggest different statistical techniques; however, both criticisms apply generally to research undertakings. Tostlebe has made an excellent beginning toward bringing together basic statistical material and establishing broad but significant trends in the capital structure of American agriculture. This extremely important area of agriculture to date has received little research emphasis in relation to its importance in the over-all agricultural picture.

The book will be a valuable asset to economists interested in the capital side of agriculture.

HOWARD G. DIESSLIN

Farm Foundation

Theoretical Welfare Economics, J. deV. Graaff. Cambridge: The University Press, 1957. Pp. x, 178. $4.00.

This book is both an account and critique of contemporary welfare economics. The first five chapters are devoted to a systematic development of welfare theory under fairly general assumptions. The following three chapters deal with the problems raised by capital accumulation, indivisibility and uncertainty. The theory is then applied to foreign trade policy, the pricing of output and the valuation of national income. The final chapter contains Graaff's conclusions.

The entire job is done in a very scholarly manner. Several new ideas are integrated with the contributions of other welfare theorists. Special attention is focused on the ethical and empirical assumptions underlying the theory. These are examined for acceptability and realism. Nonmathematical readers will find the text quite intelligible. Mathematical proofs are placed in an appendix at the end of each chapter.

Applied economists will be interested particularly in Graaff's conclusions relating to the place of welfare theory and the role of the economist in policy making. With respect to the first, he concludes that welfare theory has little to contribute to policy formulation and evaluation. He believes the factual premises are too unrealistic and some of the ethical assumptions too unacceptable to produce a useful theory. It is argued, with reason, that the introduction of more realistic empirical assumptions provides no real solution because of complications which render applications impractical. And he sees little possibility of ever constructing a useful normative model—one which is something more than the "barren formalisms typified by the marginal equivalences of conventional theory."

The problems raised by the author are unquestionably very real; they cannot be dismissed lightly as some economists have been prone to do. Whether they are of sufficient import to make the theory completely useless is perhaps doubtful. It is highly unlikely that a normative model can be developed which fits all the facts perfectly and is acceptable to everyone. But this is probably asking too much. A more rough and ready model might be quite useful, even though it has some imperfections. The question of degree seems to be of critical importance. Here, additional empirical evidence is needed in testing some of the premises.

At one point it is argued that the output of enterprises under public control should be priced on the basis of both income distribution effects

and resource allocation effects. There can be no question that both these effects are highly relevant to policy formulation. But does it necessarily follow that both should enter the final decision on the price to be charged? Suppose these are the only effects to be taken into account in setting the price. Assume that there are other methods of redistributing income which have a smaller adverse effect on resource allocation and no other significant effects. Under these assumptions, maximizing the desired effects would imply setting the price on the basis of allocation effects only. For Graaff's argument to be true, he would have to show that redistributing income via (say) the income tax would have a larger adverse effect on the allocation of resources than via the price of the product. This he does not do.

The author believes the contribution of economists to human welfare will be larger if they devote their efforts to positive studies rather than prescriptive studies. There is much to be said in favor of this viewpoint, particularly if studies of the effects of economic policies are included, as I think they should be, in the positive class.

In a democracy, economic policy will reflect the influences of various elements of public opinion. Its specific content will be determined largely by the value systems of the people, their understanding of the economic system and the distribution of effective political power. The economist's contribution is primarily in the area of improving people's general knowledge of the economy and the effects induced by changing the values of particular variables in the system. For this, positive studies are essential. However, some rationale is needed if individuals are going to put together in an intelligent manner the information they possess on ends and empirical conditions .The maximizing principles of welfare theory may provide a useful tool for this purpose.

I suspect that most readers of the *Journal,* especially those interested in policy, will find this volume worthy of considerable study. It might properly be classed as required reading for graduate students. Graaff's book is an important contribution to the growing body of welfare literature.

DONALD R. KALDOR

Iowa State College

The National Policy and the Wheat Economy, Vernon C. Fowke. Toronto: University of Toronto Press, 1957. Pp. x, 312. $5.50.

The merits and value of this book far exceed its position as the seventh in a series relating to the background and development of the Social Credit movement in Alberta. It is a historical account of the factors which

must find a place in any complete chronicle of the Social Credit movement in Western Canada.

Firstly, this book sets forth the policies and describes the events leading up to the creation of a wheat economy in the Canadian prairie region and the creation of Alberta as a Canadian Province. Secondly, it describes in some detail the agrarian agitation and farmer movements which swept the Canadian prairies since the turn of the century and culminated in the rise to political power of the Social Credit Party in Alberta.

The first of four parts into which this book is divided discusses the "National Policy." "National Policy" as used by Canadian writers in academic circles refers to the expression of economic and political nationalism during the period in which Canada was created from British North American territories to stretch as a nation across a continent. The phrase "National Policy" is unfortunate not only for the fact that it implies more uniformity of policy than existed, but also it suggests a narrow base for policy. If the "National Policy" is not tied back to a feeling of nationalism on the part of Canadians and especially English speaking Canadians, we are faced with the question of from what source did the "National Policy" stem. Imputing the National Policy to commercial and industrial interests leaves us with uncomfortable connotations.

In North America a frontier for agricultural settlement was necessary for national growth. Hence, early Canadian nationalism was unique in the tasks it had to accomplish when compared to either American or European nationalism. The tide of American settlement had to be held back from some of the British North American territories in order to preserve these for settlement under Canadian auspices. Lack of contiguous areas for agricultural settlement made the role of the railroads vital. Nationalism requires economic growth and development within national boundaries. Canada had to begin expansion from a relatively small and undeveloped economy. These facts set the main outline of the national policy as an expression of Canadian nationalism in the last half of the nineteenth century. They need not obscure its source.

This book would have been greatly improved had the concept of the investment frontier been deleted. The concept of the mature economy and the stagnation thesis have not been universally accepted. Employment of the concept of the investment frontier introduces controversy where none need exist. A discussion of economic growth and development would have been as useful. This would have side-stepped the unsubstantiated theory that investment opportunities tend to dry up in older economies. A theory relating to the stability of the private enterprise economy is irrelevant to the main theme of the book.

The treatment of monopoly at times leaves this reviewer with a feeling of uneasiness. The importance of imperfect competition in the thinking

of economists lies in its impact on the economic welfare enjoyed by the community. Monopoly is not bad for its own sake. We must look for secondary effects in terms of the distribution of income and the desirability of the bundle of goods produced in terms of the alternative bundles of goods that could have been produced. With reference to the fur trade, applying the ideas of income distribution and allocation of resources to a primitive hunter's society is an interesting problem but not necessarily a fruitful one. In terms of historical events in a dynamic economy, we must quantify the effects of monopoly in terms of income distribution and allocation of resources, so that we may weigh them against the source from which all economic welfare ultimately derives; namely, economic progress. Where economic growth and development has been hastened by the granting of monopoly rights, the community may well have gained when the various effects are weighed in the balance. It is, however, in the erasing of a monopoly no longer justified that the community may suffer a traumatic experience.

This was the situation on the Canadian prairies from the turn of the century to the first World War. Part II of the book is devoted to a discussion of the farmer movements in the Canadian West as they removed the monopoly rights of the railroads and grain handling companies. Farmer-owned grain handling facilities did much to reduce grain handling charges to actual cost. In this respect, the author points out that farmer agitation on the prairies was highly successful.

Part III of this book relates to the farmers' attempt at monopoly control of wheat marketing following the first World War. Fowke's discussion vividly depicts the farmers' thinking and aspirations. Although the author fails to point out the utter futility of what the farmer movement was attempting, it is quite apparent from his writing. By gaining control of most or all of the grain marketed the farmers hoped to gain some control of the price. The Wheat Pools and the Wheat Board were designed for this purpose. Yet the simple economic fact, that to control price control of the quantity produced is necessary, has not as yet been accepted by the Canadian farmer nor the Canadian government. Furthermore, to benefit from controlling price the demand must be inelastic. For a commodity with very close substitutes produced all over the world, it is highly improbable that the demand for Canadian wheat is inelastic in the export market.

Let us state what the Canadian wheat farmers were attempting to do in the wheat market since World War I in a fashion different from that employed by Fowke. This contrasting statement may serve to clarify our thinking. Whenever grain is held from one time period to the next without being utilized immediately, speculation takes place. Speculation

must take place if grain is to be consumed throughout the whole year. Some one must bear the risk of a price change on the unused stocks of grain. When grain is held beyond the crop year, speculation between crop years takes place. Sales and speculation of wheat are but opposite sides of the same coin since all the wheat cannot be used the moment it is harvested.

Were the Wheat Pools, the Central Selling Agency and the Canadian Wheat Board better speculators than the private speculators on the Winnipeg Grain Exchange? This is the question that must be answered to evaluate the farmer movement and government intervention in wheat marketing in Western Canada. Since government subsidies to farmers have been small, this is the only relevant question. The answer is very plain. The farmer organization and the government held grain in the face of falling prices far beyond the amount private speculators would have done.

Part III of the study by Fowke indicates the futility of attempting to manipulate the world price of wheat through speculation with Canadian wheat. It may also be unprofitable to attempt to manipulate the world price of wheat through control of the quantity of Canadian wheat produced. Should this be the case, the only alternative left for farmer agitation is to obtain a federal subsidy for the wheat economy.

Part IV, the concluding chapters of the book, attempts to integrate the "National Policy" and federal policy toward the wheat economy. For my part, I will not worry about the lack of function for the federal government now that the so-called "National Policy" has been accomplished. Canadian nationalism will find other tasks for it to perform.

This book is well-written. Despite a critical examination of actions and events, Fowke has not dealt unsympathetically with his subject. This enhances the readability of the book. Each topic is completely dealt with before proceeding to the next. In this fashion the many phases of the same problem are adequately handled with the minimum of repetition. The reviewer is very grateful to Fowke for writing this book, and he appreciates the tremendous amount of time and effort this work required. It brings into focus the objectives of the agrarian revolt on the Canadian prairies as no other writing has done. Given these objectives and the methods used to attain them, perhaps we, as economists, can contribute something to policy.

For all those interested in Canadian economic development, in agrarian agitation and farm movements whether American or Canadian, for all those interested in the co-operative movement and in agricultural policy, this book is required reading.

CONRAD GISLASON

State College of Washington

Economic Models: An Exposition, E. F. Beach. New York and London: John Wiley & Sons, 1957, Pp. ix, 227. $7.50.

Nowadays the serious student of economics is always running across references to economic models. In a sense this is nothing new. All economists have always used models. For example, such things as demand curves and cost curves are models. But today economists and statisticians are using bigger and more detailed economic models. Often such models are presented in terms of a larger number of simultaneous equations. Many economists are finding it difficult to keep up with recent developments in model-making and model-using.

Some of these economists have doubtless been helped by many of the recent books on econometric method, including the books by Allen, Tintner, and Klein. But these books are highly mathematical. Beach says in his preface that he is not attempting "to add to current knowledge of mathematical economics or statistics," but rather he is trying "to put this knowledge in a form that can be readily digested by beginners." He has certainly presented a great deal of interesting material in simple, understandable form. Anyone who can handle ordinary problems in algebra will be able to understand most of this book. I believe that Beach has been reasonably successful in accomplishing a very worthwhile purpose.

Part I deals with what the author calls "Mathematical Models." He evidently includes in this term any sort of diagram or non-quantitative model used to describe a theory. As an example, consider the models developed by Hicks and others for the purpose of explaining the theories developed by Keynes. Probably very few people really understood the Keynesian theories until they had been explained in terms of models or sets of equations. Now it is possible for an economist with a rather elementary training in mathematics to understand Keynes, perhaps even better than he understood himself.

These remarks are not intended to indicate that Beach is especially preoccupied with Keynesian theory. He is not. Part I of his book covers a wide range of mathematical models. He discusses linear and nonlinear equations, macro and micro models, static and dynamic relations, multipliers, accelerators, and many other modern concepts. He shows how such models can be analyzed to discover equilibrium values if they exist.

This is done without using any complicated mathematics. Beach does make some use of elementary principles of the differential calculus. He discusses these principles in six pages. Probably a good many economists will want to learn more about the calculus than they will find in these six pages. But, after all, this is not a book on mathematics, but a book on economic models.

Part II deals with what the author calls "Econometric Models." As I

understand it, an econometric model is one that is built upon actual statistical data and is intended to be a fairly good approximation of actual quantitative relationships in the real world. (Incidentally, it is deplorable to note how few of the so-called "econometric" papers are based upon quantitative statistical measurements.) Agricultural economists have been in the forefront in developing econometric models. Among the pioneers, for example, were Moore, Henry Schultz, and Ezekiel. Econometric models, as well as mathematical models, are becoming more and more complicated. Moore, Schultz, and Ezekiel were satisfied with single least-squares regression equations. Today many economists apparently think these simple regression equations are old-fashioned or "biased." My own opinion is that simple regression equations are still, and always will be, extremely important,—that they provide the only unbiased estimates of the expected value of one of the variables. On the other hand, structural analysis can help us understand the interrelationships between supply, domestic demand, exports, and stocks of a commodity like wheat, even though we may be able to forecast wheat prices more accurately by a single least-squares equation.

In the part of the book dealing with econometric models, Beach finds it necessary to discuss the elements of statistical theory. He takes a little more space for this than he did to discuss the differential calculus. Still, more readers who are really interested in econometric models will want to learn much more about statistical analysis than they will find in this book. This is not intended as a criticism. Readers can turn to some of the other recent books to get a more detailed discussion of mathematical method and statistical theory. I think the elementary discussion of statistical theory in this book doubtless will be useful to many economists who have some training in economic theory but little in mathematics and statistics.

In general, the book should give most readers a fair understanding of what the model-builders have been up to, how far they have got, and the general nature of their findings. This is a very substantial accomplishment.

FREDERICK V. WAUGH

U. S. Department of Agriculture

Managing for Greater Returns in Country Elevator and Retail Farm Supply Businesses, Richard Phillips. Des Moines: Farmers Grain Dealers Association of Iowa, 1957. Pp. xiii, 558. $7.00.

Managing for Greater Returns with emphasis given to local businesses serving agriculture is a book that has its roots in economic reasoning. This book points up the fact that management is more than an art; it represents

the application of scientific relationships and principles. At the same time, it is evident that Phillips has had considerable firsthand experience with managers of small businesses which has enabled him to realistically identify and categorize management problems.

The book is divided into two parts: (1) planning the organization and operation of business, and (2) managing the business operation. The chapters under planning give emphasis to charting the business and establishes the potential which can be achieved. The chapters in the second part deal with the utilization and execution of the plans in operating the business. Phillips is careful to point out that planning and execution are not mutually exclusive but are integrated functions of management.

After an opening chapter dealing with the role of management, Chapter II contains the economic framework applicable to managerial planning and operation. It is an excellent review of production economics relevant to small local businesses serving agriculture. To some readers, only certain chapters may be of interest, but in every case Chapter II should be read first because it provides the framework or set of conditions which specify the organization necessary to achieve the goal of making business as profitable as possible. For some, more than likely students of business management, the appendix to Chapter II will be meaningful because it provides a more formal and complete working concept of the economic framework for managerial planning.

A strong feature of this book is Phillips' willingness to be specific in stating conclusions and showing the reader what is involved in managing for greater returns. It is safe to assume that thoughtful readers will learn much by reading this book even though they may be experienced managers or students in this field.

This book is well-suited as a basic text in college courses for students preparing themselves for positions with small firms serving agriculture. It may be that most curricula in agricultural economics have not had a course in managing for greater returns because a suitable text has not been available. Phillips has written an excellent book and student interest seems to be increasing; so, now may be time to add such a course. It is hoped businesses serving agriculture learn that a book dealing with managerial problems is available. Experienced management can find this book useful as a means of increasing net returns and those aspiring to managerial positions need it as study material.

Phillips' book is a welcome addition to the field of agricultural economics. Individuals having an interest in management, and most of us do, will find this book interesting and useful even though we may not be teaching a course in this area at present.

GERALD E. KORZAN

Oregon State College

The Demand and Price Structure for Dairy Products, Anthony S. Rojko. Technical Bulletin 1168, U. S. Department of Agriculture, Agricultural Marketing Service, Washington, D.C., 1957. Pp. 252.

In the words of the author, "The major contribution of this bulletin is in the formulation and statistical fitting of relations that describe the economic influences which affect prices and consumption of milk and dairy products. . . . In addition to their use for analysis of price and consumption movements and assistance in gaging future trends, results of these analyses can be used to indicate probable effects of certain government programs. . . . The bulletin also brings together a mass of information relating to other economic influences and institutions that affect prices and consumption of dairy products. Inclusion of these subjects is to aid in the interpretation and use of the formal results obtained from statistical analyses. These subjects include: (1) methods of pricing fluid and manufacturing milk, (2) government participation with respect to fluid milk, (3) government price support programs, (4) price relationships among different marketing levels, (5) seasonal variation in prices, and (6) price differentials by regions and markets."

Instead of praising the author for numerous sections that were developed strongly, it is believed that the value of the review would be increased by critical arguments about some possible short-comings. This is not intended to detract from the general opinion that researchers should carefully read this bulletin—especially those interested in aggregate economics for the milk industry of the United States.

The first arguments are directed at Rojko's four structural models of which only the last has major relevance. It is not clear to me why the retail price relationships were included in the structure. Seemingly, the structure would be logically complete with: (1) the retail demand functions, (2) the market system functions connecting the retail price indexes with the farm price index for milk (assuming equal prices were actually received in all outlets), and (3) the farm level aggregate demand function (assuming total supply fixed exogenously). The retail price relationships appear as a disconnected appendage, since the individual price indexes were used in the demand functions. The admission of these equations into the model would not have been deemed potentially damaging if the primary nature of the variables had been carefully considered. They are functions connecting sets of group index numbers (deflated by another index number) with the aggregate index numbers for the entire set. Fixed weighting of the group indexes as they are aggregated into the full index must place some restrictions on the coefficients of structural equations linking the parts to the full index. These mechanical restrictions on the coefficients should be a part of the structural specification so that inconsistent estimation will not result. Their specification does not appear to be a simple task.

It is a fact that returns to farmers at the first point are not equal—partly due to locational conditions and partly due to entry costs and institutional barriers. The farm price index used by Rojko is made up of component parts by outlet designation and was used in the farm level demand function. It is at this level that price functions, similar to those discussed above, should have been postulated and not at the retail level.

The designation of total milk supply as exogenously fixed is reasonable and convenient, but it is probable that as much as 5 per cent variation within a year could be accounted for endogenously. Perhaps some reasonable function could have expressed this and improved the model. Even with the acceptance of the exogenous determination of annual supply, the specification of a function of lagged variables to explain the flow would have permitted a fuller coverage of the sequence path without price support programs. As it was, all that could be considered was year by year effects. The cumulative impact would have been an interesting example of how tight and long the wringer would have squeezed before supply adjustments would produce acceptable prices and returns.

Lack of detail with respect to time, space, and form aspects of an industry's economy in these concentrated annual models is a limit on their utility. Universally, analysts flee from the difficulty of correcting models for these details and the apparent noncompetitive rigidities of the real marketing institutions. Piecemeal analyses and discussions are developed separately to cope with these details and deviations. The latter half of Rojko's bulletin deals with these areas and does it quite well. It would have been an interesting development if a fuller consideration of the association between Class I and surplus pricing had been made. The potential of returns on Class I (with a low surplus price) subsidizing surplus uneconomic manufacturing production areas through excessive surplus milk production with a high blend price was alluded to but not pursued.

The search for the best estimates of price and income elasticities will undoubtedly continue. Rojko's results are reasonably consistent with other efforts. All indicate relatively low elasticities. A classification of the meaning of the alternative forms of these answers (between year basis, year-to-year basis, cross-sectional basis, etc.,) would be welcome. The time dimension association as well as the applicability to short and long period decisions at various levels of the industry is vague. Impact of these elasticities on individual producer returns is dependent on the comparative structure of the supply function—new entry and exit versus existing producer expansion and contraction.

JAMES B. HASSLER

University of Nebraska

NEWS NOTES

DANIEL D. BADGER has been appointed Instructor in Agricultural Economics, Oklahoma State University, where he is continuing to study toward the Ph.D. degree.

MARTO A. BALLESTEROS has been appointed Instructor in Economics at the University of Chicago and is serving in Santiago, Chile, at the Catholic University of Chile, under a university-to-university contract with the International Cooperation Administration.

K. RAY BARLOW will work in marketing as Assistant Professor of Agricultural Economics at the University of Arizona. He was formerly on the staff at the University of Idaho.

GEORGE W. BARR has resigned as Head of the Department of Agricultural Economics, University of Arizona, to accept a position with United Nations as Economic Consultant to the Bank of Northeast Brazil, at Fortaleza, Brazil. He had served as head of the department at Arizona since its establishment in 1935.

OWEN D. BELCHER has been appointed an Assistant in Agricultural Economics at the Alabama Polytechnic Institute. He will be engaged in full-time research work on cooperative research with TVA relative to credit and fertilizer use in Alabama.

CALVIN R. BERRY, Assistant Professor in Agricultural Economics, returned to the University of Arkansas in December from Purdue University where he completed work for his Ph.D.

JYOTI BHATTACHARJEE, Ph.D., Illinois, has recently accepted an appointment with the Ministry of Agriculture at New Delhi, India.

JOEL L. BLUM has joined the staff of the Federal Milk Market Administrator, Philadelphia, as Economist. He was formerly with the Dairy Division, USDA, and had more recently been in private business.

BILL BOLTON has resigned from the staff at Louisiana State University and is now employed by the Farm Economics Research Division, ARS, stationed at Baton Rouge.

JAMES O. BRAY, Associate Professor of Economics at the University of Chicago, is serving his second year at the Catholic University of Chile under a university-to-university contract with the International Cooperation Administration. Four men from the Catholic University have been sent to the U.S. to study: Hernan B. Lagomarsino on an I.C.A. fellowship to Michigan State University; Hector H. Yanes on an I.C.A. fellowship to Purdue University; Eduardo V. Leigh on a Fulbright Fellowship to Iowa State College; and Raul Yver on a Chilean Research Training Fellowship to the University of Chicago.

GEORGE E. BRANDOW returned to the staff of Pennsylvania State University in February, following a leave of absence of eight months to serve as economist for the Subcommittee on Agricultural Policy of the Joint Economic Committee of the 85th Congress.

HOWARD L. BROSSARD of the State Statistician's Office in Alexandria, Louisiana, moved to Richmond, Virginia, in February to work in the State Statistician's Office there.

SIDNEY E. BROWN joined the staff of Market Development Branch of AMS after completing work for his Master's degree at Virginia Polytechnic Institute and serving 15 months in Japan with the armed forces.

J. LOSSING BUCK retired after three years of service as the Director of Agricultural Economics for The Council on Economic and Cultural Affairs last August.

THOMAS F. CARROLL is returning to FAO headquarters in Rome after spending one year in Santiago where he was land tenure advisor to the Chilean government.

HAROLD O. CARTER, Iowa State College, has accepted an appointment at the University of California, Davis, as an Assistant Agricultural Economist beginning February 1, 1958.

CHAIYONG CHUCHART completed requirements for the Ph.D. at Louisiana State University and has returned to his position as Instructor in Agricultural Economics, Kesetsart University, Bangkok, Thailand.

JOHN B. CLAAR, Division of Agricultural Economics Programs, Federal Extension Service, has been chosen to fill a post as field representative in the office of the Administrator, FES. Claar joined the federal staff as Chief, Farm Management and Production Economics Branch, in September, 1955.

WILLARD W. COCHRANE, Professor of Agricultural Economics at the University of Minnesota, will be a visiting professor in the Department of Economics for the year 1958-59 at the University of Chicago.

FREDERIC A. COFFEY, of the Agricultural Price Statistics Branch, Agricultural Estimates Division, Washington, D.C., moved to the State Statistician's Office at Oklahoma City, Oklahoma, in January.

WILLIAM J. COLEMAN has returned to duty with the Farm Economics Research Division, ARS, from military furlough.

WARREN E. COLLINS, formerly with the Illinois Agricultural Association, is now on the research staff of the American Farm Bureau Federation.

J. B. CUNNINGHAM and C. L. STEWART, of the Department of Agricultural Economics of the University of Illinois, had a major part in producing the color film, "What Is a Farm Worth?" which was chosen as the February 1958 film of the month by the USDA.

REX F. DALY, Supervisory Analytical Statistician in Agriculture, spent a month in Nicaragua to advise that country on its agricultural potential in the light of projected import needs. He will be working for the International Cooperation Administration.

FRED DANIELS, former State Statistician in New Mexico, retired in December after 34 years of government service. He has been succeeded by Roger H. Sutherland who had been working in the Field Crop Statistics Branch in Washington, D.C., prior to his new duties.

J. A. DAWSON has been appointed Secretary of the Royal Commission investigating price spreads of agricultural products in Canada.

D. BARTON DELOACH resigned in March from his position as Chief of the Market Organization and Costs Branch, AMS, to become Professor of Agricultural Economics and Vice Chairman of the Giannini Foundation of Agricultural Economics at the University of California at Los Angeles. Kenneth Ogren, formerly Head of the Marketing Information and Statistics Section of the same branch became the new Chief of the Market Organization and Costs Branch.

KEITH DEXTER has joined the British Ministry of Agriculture in agricultural economics work.

N. GENE DUNNUCK, instructor in Agricultural Economics, joined the staff at the University of Arkansas in January.

JAMES ELSON and FRED MANN, members of the staff of the Department of Agricultural Economics, University of Illinois, were recently admitted to the Illinois bar.

MERRILL EVANS has been appointed Associate Professor in Extension at Michigan State University effective April 15. At present with the Ford Motor Company, he will do work in the market agency education project, specializing in the area of general business management.

ADRIEN J. FALK, San Francisco businessman and former president of S and W Fine Foods, Inc., has accepted appointment as Regents' Professor of Agricultural Economics at the University of California. Falk will review and analyze in open seminars many of the basic decisions he made during his long career with S and W. For graduate students and faculty, these experiences will provide real-life examples of successful business policies on merchandising and pricing, organization, plant location and expansion, labor relations, and other problems of business management.

ERNEST FEDER of the Department of Agricultural Economics, University of Nebraska, has been awarded a nine month Fulbright lectureship at the University of Chili, Santiago.

The Department of Agricultural Economics, University of Arkansas, reports with regret the death of VIRGIL B. FIELDER on February 17. He had been on the faculty since 1943.

EARL I. FULLER recently joined the staff of the University of Minnesota as Research Fellow. He was formerly in Farm Management Extension at Michigan State University.

ELCO GREENSHIELDS, Farm Economics Research Division, ARS, returned to Washington, D.C., in December after spending five weeks at FAO headquarters in Rome, where he made an intensive study of documents relating to the Ganges-Kobadak Irrigation Scheme in East Pakistan. He departed for East Pakistan in February for a three month period.

HAROLD G. HALCROW, Head of the Department of Agricultural Economics of the University of Illinois, was recently reappointed to the Board of Directors of the National Bureau of Economic Research for a five year term to represent the AFEA.

CHARLES M. HARDIN, Associate Professor Political Science at the University of Chicago, studied agricultural policy and related political matters in Latin America during 1957-58 under a grant from the Social Science Division of the Rockefeller Foundation.

JOHN T. HARRIS, who recently completed his Ph.D. in agricultural economics at the University of Illinois, has been promoted to manager of the Fiscal Agency Department of the Federal Reserve Bank of Atlanta.

HOLLIS A. HATFIELD has joined the Pennsylvania Farmers' Association as Director of Public Affairs after completing graduate work at the University of Illinois.

HARRY HATHAWAY, formerly of Michigan State University, is Extension Poultry Marketing Specialist at Louisiana State University.

GUY L. HAVILAND reported for duty with the Farm Economics Research Division, ARS, in February to work on problems of water utilization. He was formerly with the Animal Husbandry Division of ARS.

WILLIAM MCDANIEL HERR, formerly agricultural economist with the Chicago Federal Reserve Bank, joined the staff of the Department of Agricultural Industries at Southern Illinois University in October as an Associate Professor.

WILMOT G. HILL, Office of the State Statistician at Oklahoma City, Oklahoma, transferred to the Washington Office of the Agricultural Estimates Division in January. He will work in the Agricultural Price Statistics Branch.

JIMMYE S. HILLMAN has returned to his position as Associate Professor of Agricultural Economics at the University of Arizona after two years' leave, during which time he served as Agricultural Economist, United States Operation to Brazil at Rio de Janeiro.

GEOFFREY HISCOCKS, who has been on the agricultural economics staff of the Ministry of Agriculture in London, has joined the staff at Cambridge University.

JAMES B. HORNE recently joined the Agricultural Economics Extension staff at Pennsylvania State University and has been assigned as marketing agent in the southeastern area of the state.

ROY HOVEY has been appointed instructor in Agricultural Economics at Kansas State College to assist Professor Wilfred H. Pine with research on economic impacts on highways.

EARL M. HUGHES, after returning to his farm last fall from his position as administrator of the Agricultural Stabilization Service of the AMS in Washington, was elected to the Board of Trustees of the University of Illinois.

WELLS HUTCHINS, Farm Economics Research Division, ARS, stationed at Berkeley, retired in February, but will continue his work with the Division for another year on a temporary appointment.

JAMES A. HUTCHINSON has been appointed an Assistant in Agricultural Economics at Alabama Polytechnic Institute to conduct research in farm management and production economics.

D. GALE JOHNSON, Professor of Economics and Associate Dean of the Division of the Social Sciences at the University of Chicago, has been granted a faculty research fellowship for the coming year by the Ford Foundation under their program in economic development and administration.

HAROLD B. JONES, JR., joined the staff of the Market Organization and Costs Branch, AMS, in January. He is stationed at Durham, New Hampshire, where he will do research on integration in the poultry industry.

ARCADIUS KAHAN is at the University of Chicago as research associate engaged in a study of Russian agriculture.

JAMES R. KENDALL, from the Office of the State Statistician at Springfield, Illinois, transferred to the Washington office of the Agricultural Estimates Division in February. He will be Assistant to the Secretary of the Crop Reporting Board.

STANLEY F. KRAUSE has been appointed Chief of the Dairy Branch of Farmer Cooperative Service, USDA.

WESLEY R. KRIEBEL recently joined the Agricultural Economics Extension staff at Pennsylvania State University and has been assigned as marketing agent in the southcentral area of the state.

ADLOWE L. LARSON, who has been on leave of absence to pursue post-doctoral study at the University of California, Berkeley, has resumed his position as Professor of Agricultural Economics at Oklahoma State University.

WAYNE A. LEE returned to the staff of Pennsylvania State University in December, following a leave of absence of one year to work with the Market Research Corporation of America.

RUSSELL LLOYD, Farm Economics Research Division, ARS, stationed at Nevada,

has been appointed Secretary-Treasurer of the Nevada Section of the American Society of Range Management.

FRANK LOWENSTEIN, Supervisory Analytical Statistician in Agriculture, is on one year's leave to work for Robert Nathan Associates, Inc. in Burma.

WILLIAM MANNLEIN, Farm Economics Research Division, ARS, has returned to work on watershed evaluation studies in Paris, Arkansas, after a tour of duty with the U.S. Army.

CLYDE B. MARKESON, formerly with the Agricultural Research Service, has joined the Fruit and Vegetable Branch of the Marketing Division of Farmer Cooperative Service, USDA.

VERNON MCMINIMY has been appointed to the Agricultural Economics staff at Kansas State College to assist Professor Leonard Schruben with grain marketing research.

H. LOUIS MOORE recently joined the Agricultural Economics Extension staff at Pennsylvania State University and has been assigned as marketing agent in the northwestern area of the state.

LEO J. MORAN has been appointed as Assistant Professor of Agricultural Economics at the University of Arizona following completion of his Ph.D. degree at Wisconsin.

ARTHUR T. MOSHER has been appointed executive director of The Council on Economic and Cultural Affairs, Inc.

WILLIAM MOTES has resigned as instructor in Agricultural Economics at Kansas State College to pursue graduate study at Iowa State College.

JOE MOTHERAL has resigned from the Farm Economics Research Division, ARS, to accept a position with Harvard University as Agricultural Advisor to the National Planning Board of Pakistan, and is now in Karachi.

HAROLD E. NEIGH recently joined the Agricultural Economics Extension staff at Pennsylvania State University and has been assigned as marketing agent in the southwestern area of the state.

AARON NELSON has been appointed Professor of Agricultural Economics at the University of Arizona. He was formerly Director of Research and Education for the Omaha Farm Credit District and will work in farm management and agricultural credit at Arizona.

S. DANIEL NEUMARK, acting economist in the Food Research Institute, Stanford University, is on leave of absence with the Bureau of Economic Affairs of the United Nations. He is assisting with a survey of current economic developments in Africa.

WILLIAM H. NICHOLLS became Chairman of the Department of Economics and Business Administration, Vanderbilt University, on February 1.

JEROME K. PASTO, Pennsylvania State University, was recently director of a regional seminar on farm planning and farm management held in India and sponsored by FAO with the cooperation of the government of India.

JAVAD PIROUZBAKT has been named Dean of the College of Agriculture at Shiraz, Iran.

MARGARET REID, Professor of Economics at the University of Chicago, has been granted a faculty research fellowship for the current year by the Ford Foundation under their program in economic development and administration.

J. B. RUTHFORD, Fisheries Department, has been appointed director of research for the Royal Commission investigating price spreads in Canada.

JANE L. SCEARCE has retired from the staff of the Marketing Division of Farmer

Cooperative Service. She served in the government for 39 years, 30 of which were in work with farmer cooperatives.

RAINER SCHICKELE, Chief of the Land and Water Use Branch, has returned to Rome after an extended leave in the United States which took him to many American agricultural colleges.

THEODORE W. SCHULTZ has returned to the Department of Economics of the University of Chicago after a year at the Center for Advanced Study in the Behavioral Sciences. This past summer he attended the Conference on Economic Development at the University College of the West Indies, Jamaica. He also read a paper at the sessions of the International Economic Association in Rio de Janeiro, Brazil, and visited the Catholic University of Chile in Santiago to review the program of the Economics Research Center. He is now organizing a workshop in the Department of Economics to concentrate on economic growth and agriculture in poor countries. This will be a part of a $200,000 Ford Foundation grant to the Department to support the work of research workshops in various fields of economics. Schultz has recently been appointed chairman of the Research Advisory Board of the Committee for Economic Development.

RAYMOND E. SELTZER has been named head of the Department of Agricultural Economics at the University of Arizona.

MARTIN S. SIMON has resigned from AMS to accept a position with the Connell Rice and Commerce Company at Stamford, Connecticut.

HERMAN M. SOUTHWORTH, former Assistant to the Deputy Administrator for Research and Statistics, AMS, joined the staff at the Pennsylvania State University last July as Professor of Agricultural Economics.

CLYDE ST. CLERGY has joined the staff at Louisiana State University as Instructor in Marketing.

JAMES L. STALLINGS joined the staff of New Mexico A & M College as Assistant Professor of Agricultural Economics on February 1 after completing his Ph.D. work at Michigan State University.

GEORGE W. STOCKING asked to be relieved of his duties as chairman of the Department of Economics and Business Administration, Vanderbilt University, as of February 1, 1958, but continues as Director of Vanderbilt's Institute of Research in the Social Sciences.

GENE SULLIVAN has resigned from the Agricultural Economics staff at Louisiana State University to enter military service.

JOSEPH G. THOMAS, JR., formerly with the Office of the State Statistician at Oklahoma City, Oklahoma, transferred to the Office of the State Statistician at Springfield, Illinois, Agricultural Estimates Division, in February.

HARLON D. TRAYLOR completed requirements for the Ph.D. at Cornell and joined the staff at Louisiana State University as Assistant Professor of Marketing in March.

A. H. TURNER has been appointed Vice Chairman of the Canadian Agricultural Stabilization Board organized in March.

LUTHER G. TWEETEN has been appointed Instructor in Agricultural Economics, Oklahoma State University, where he is continuing to study toward the Ph.D. degree.

AUBREY D. VOSE recently joined the Agricultural Economics Extension staff at Pennsylvania State University and has been assigned as marketing agent in the northeastern area of the state.

ELDON WHEELER has been appointed Instructor in Agricultural Economics at the University of Arizona.

D. B. WILLIAMS has recently been made officer in charge of the Commonwealth Scientific and Industrial Research Organization in Australia. This is an organization somewhat similar to the Farm Foundation in this country.

CHARLES WILMOT has been appointed Assistant Professor of Agricultural Economics at the University of Arizona after completing his Ph.D. degree at Purdue.

LAWRENCE WITT has accepted a position as Director of Studies, Office of International Programs at Michigan State University for the calendar year 1958. Under a grant of $135,000 from the Ford Foundation, he will organize a series of all-university faculty study seminars to consider how an international dimension for teaching, research and service may be built into the on-going activities of the institution. He will continue one-fourth time as professor (teaching) of Agricultural Economics.

ALOIS F. WOLF, employed for a number of years as an economist with the Hill Brothers Company, New York City, is accepting employment in the Market Development Branch, AMS.

MARTIN D. WOODIN is the new head of the Department of Agricultural Economics at Louisiana State University, replacing Bueford M. Gile who retired after 19 years of service.

WILLARD WOOLF has been appointed Instructor in Farm Management at Louisiana State University.

AUSTRALIAN AGRICULTURAL ECONOMICS SOCIETY

In February 1957, 120 agricultural economists from every State of the Common wealth, the Australian Capital Territory and from New Zealand met in Sydney to establish the Australian Agricultural Economics Society.

C. P. Dowsett, Honorable Secretary, writes that the new organization's objectives are: 1) stimulate discussion on rural economic problems, 2) encourage training and research in agricultural economics, and 3) promote high standards of accomplishment in research, teaching and extension in this field.

The program of the second conference, a two-day session at Canberra in February, 1958, included the following topics: Agricultural Marketing Research, Agricultural Experiments and Their Economic Significance, Long Term Trends in Agriculture's Terms of Trade, The Challenge of the Dairying Industry, and Australian Agricultural Statistics-Activity Classification of Farms as an Aid to Research.

INTERNATIONAL CONFERENCE OF AGRICULTURAL ECONOMISTS

The tenth International Conference of Agricultural Economists will be held from August 24 to September 4, 1958, at Mysore City, India, which is reached by way of Bangalore. Note the change in date as some delegates expect to attend both the AFEA meeting and the ICAE.

All delegates are invited to travel by special train for about a week from Mysore to northwest India and back to Delhi with appropriate visits en route. The Indian government is subsidizing to a considerable degree the costs to Conference members while in India and is doing its very best to make the visit a happy and profitable one.

Present plans indicate the minimum necessary total expense from New York, including the Indian tour, may be less than $1,200 tourist fare, assuming a chartered plane can be obtained. If a chartered plane is not available the cost will be about $150 higher.

More information on program, travel assistance and other details will go promptly to those who have made inquiry. Prospective attendants are asked to write to H. C. M. Case, Secretary-Treasurer, ICAE, College of Agriculture, 305 Mumford Hall, Urbana, Illinois, or Joseph Ackerman, Farm Foundation, 600 South Michigan Ave., Chicago 5, Illinois.

EMPLOYMENT COMMITTEE ANNOUNCEMENT

The Employment Committee of the Association again this year will make available at the annual meeting a file of employment opportunities and employee availability. Forms are being mailed to colleges and other agencies for appropriate distribution. Persons desiring additional forms should address their requests to the chairman of the committee, Richard A. King, Department of Agricultural Economics, North Carolina State College, Raleigh, N.C.

PH.D. DEGREES CONFERRED IN AGRICULTURAL ECONOMICS

RAYMOND A. BAILEY, B.S. Ohio State University 1946; M.S. Ohio State University 1948; Ph.D. Ohio State University 1957, A Farm Management Analysis of the Swine Enterprise in a Commercial Swine Producing Area in Ohio.

CHARLES L. BEER, B.S. University of Minnesota 1948; M.S. Michigan State University 1955; Ph.D. Michigan State University 1957, Effect of Acreage Control Programs on Crop and Livestock Operations on Selected Michigan Farms.

JOHN T. BENNETT, A.B. Harvard University 1950; M.S. Harvard University 1952; Ph.D. University of California 1957, An Economic Analysis of Market-control Programs for California Clingstone Peaches.

ERIC RICHARD BERG, B.A. University of Texas 1947; M.A. University of Texas 1954; M.S. University of Illinois 1955; Ph.D. University of Illinois 1957, The Export Market for Edible-Soap Fats and Oils.

RAY VERNE BILLINGSLEY, B.S. Oklahoma A & M College 1949; M.S. Oklahoma A & M College 1952; Ph.D. North Carolina State College 1957, Programming Grain Movements to Determine Optimum Storage Locations in North Carolina.

GORDON E. BIVENS, B.S. Iowa State College 1950; M.S. Iowa State College 1953; Ph.D. Iowa State College 1957, Firm-Household Interdependence and Other Factors in Relation to Use of Credit by Farm Families in Greene County, Iowa.

MARTIN ALEXANDER BLUM, B.S. Cornell University 1950; M.S. Purdue University 1952; Ph.D. Cornell University 1957, Measurement of Rate of Movement of Apples into Consumption Using the Retail Store-Customer Observation Method.

WILFRED VARDY CANDLER, B. Ag. Sc. Massey Agricultural College, New Zealand, 1954; M. Ag. Sc. Massey Agricultural College 1955; Ph.D. Iowa State College 1957, Linear Programming with Stochastic Yields.

SHIH-AN CHIEN, B.S. University of Nanking 1950; M.S. University of Wisconsin 1954; Ph.D. Ohio State University 1957, Frozen Foods With Special Reference to Consumer Use in Columbus, Ohio.

RONDO A. CHRISTENSEN, B.S. Utah State Agricultural College 1954; M.S. Cornell University 1955; Ph.D. Cornell University 1957, A Business Management Study of Seventy-three Retail Farm Equipment Firms, New York, 1955.

CHAIYONG CHUCHART, B.S. Kasetsart University 1946; M.S. Louisiana State University 1957; Ph.D. Louisiana State University 1957, Rice Marketing in Thailand.

NIJMEDDIN I. DAJANI, B.A. University of Wales 1950; Ph.D. University of Wisconsin 1957, Economic Appraisal of the Yarmuk Jordan Valley Project.

BASHIR JAMIL DAOUK, B.A. American University of Beirut 1950; M.S. University of Wisconsin 1953; Ph.D. University of Wisconsin 1957, Growth in Agricultural Output of Syria and Lebanon: 1926-54.

JOHN ADDINGTON DAWSON, B.S. McGill University (Macdonald College) 1943; M.S. University of Illinois 1949; Ph.D. University of Chicago 1957, The Demand for Irrigation Water in the Ainsworth Area of Nebraska.

GERALD WALLACE DEAN, B.S. Iowa State College 1952; M.S. Iowa State College 1955; Ph.D. Iowa State College 1957, Supply Functions for Hogs.

MICHELE DEBENEDICTIS, B.S. University of Naples, Italy, 1950; M.S. Iowa State College 1955; Ph.D. Iowa State College 1957, Intratemporal Resource Efficiencies in Leasing Systems—An Application of Linear Programming.

EDDIE VEE EASLEY, B.S. Virginia State College 1948; M.S. Iowa State College 1951; Ph.D. Iowa State College 1957, An Application of Linear Programming to the Study of Supply Response in Dairying.

THEO HUFFMAN ELLIS, B.A. University of Florida 1938; B.S.A. University of Florida 1948; M.S.A. University of Florida 1951; Ph.D. University of Florida 1957, Optimum Programs in Columbia and Suwanee Counties, Florida.

ROBERT MCLAREN FINLEY, B.S. Kansas State College 1950; M.S. Kansas State College 1953; Ph.D. University of Illinois 1957, Determination of Optimal Resource Allocation for Farms in the Claypan Region of Illinois.

JOHN HENRY FOSTER, B.S. Cornell University 1950; M.S. Purdue University 1951; Ph.D. Cornell University 1957, Change in the Rural Areas of St. Lawrence County, New York.

DONALD K. FREEBAIRN, B.S. University of Illinois, 1950; M.S. University of Illinois 1952; Ph.D. Cornell University 1957, An Analysis of Farm Financial Progress of Selected Farmers in New York State.

RONALD GATTY, M.S. Cornell University 1952; Ph.D. Cornell University 1957, A Market Development Program for Cut Flowers.

ABBAS GHEZELBASH, B.S. Utah State College 1953; M.S. Utah State College 1954; Ph.D. Ohio State University 1957, An Econometric Analysis of the Greenhouse Tomato Market in Ohio.

DOROTHY CHENEY GOODWIN, A.B. Smith College 1937; Ph.D. University of Connecticut 1957, Economics of a Coordinated Property Tax and Grant Program in Connecticut.

H. ZVI GRILICHES, B.S. University of California 1953; M.S. University of California 1954; M.A. University of Chicago 1955; Ph.D. University of Chicago 1957, Hybrid Corn: An Exploration in Economics of Technological Change.

SADUN LAWLAH HAMMADI, B.A. American University of Beirut 1952; M.S. University of Wisconsin 1955; Ph.D. University of Wisconsin 1957, Agricultural Taxation in Iraq.

WILLIAM RAY HENRY, B.S. University of Arkansas 1948; M.S. University of Arkansas 1953; Ph.D. North Carolina State College 1957, An Economic Analysis of North Carolina Lettuce Marketing Practices.

JOHN HERMAN HERBST, B.S. University of Illinois 1942; M.S. University of Illinois 1951; Ph.D. University of Illinois 1957, Changes in Labor Productivity in Illinois Agriculture, 1944 to 1954.

HOWARD LYLE HILL, B.S. South Dakota State College 1951; M.S. University of Wisconsin 1955; Ph.D. University of Wisconsin 1957, An Economic Appraisal of Adjustments in Conventional Leasing Arrangements to Facilitate Capital Accumulation.

MOHAMMED KAMEL HINDY, B.S. University of Cairo 1942; M.S. University of Wisconsin 1955; Ph.D. University of Wisconsin 1957, Application of Some Sampling Techniques to Improve the Collection of Agricultural Data in Egypt.

WILLIAM DAVID HOPPER, B.S. McGill University (Macdonald College) 1950;

Ph.D. Cornell University 1957, The Economic Organization of a Village in North-Central India.

SAM CHUNG HSIEH, M.S. National Central University, Nanking, China, 1945; Ph.D. University of Minnesota 1957, Rice and Sugar Cane Competition on Paddy Land in Central Taiwan.

LINLEY E. JUERS, B.S. University of Minnesota 1953; M.S. University of Minnesota 1954; Ph.D. University of Minnesota 1957, An Economic Analysis of the Operating Costs of Butter-Powder Plants with Particular Reference to the Problems of Joint Costs.

SHOHEI KAWAKATSU, B.A. Kyoto University 1952; Ph.D. University of Wisconsin 1957, Some Methods of Estimating Fertilizer Response Functions for Refinement of Diminishing Returns Analysis.

ARVID C. KNUDTSON, B.S. University of Minnesota 1950; M.S. University of Minnesota 1953; Ph.D. University of Minnesota 1957, An Analysis of Processing Costs in Specialized Butter Plants Receiving Whole Milk.

ORVILLE KRAUSE, B.A. Marietta College 1938; M.S. University of Wisconsin 1950; Ph.D. University of Wisconsin 1957, Wisconsin Feeder Pig Markets and Prices.

MARION R. LARSEN, B.S. Utah State Agricultural College 1947; M.S. Utah State Agricultural College 1948; Ph.D. University of Maryland 1957, Competitive and Marketing Aspects of the Maryland Cantaloupe Industry.

ROY LELAND LASSITER, JR., B.S. University of Florida 1953; Ph.D. University of Florida 1957, An Analysis of the Movements in Agricultural Land Prices and Values in Palm Beach County, Florida, 1940-1955.

THEODORE W. LEED, B.S. Ohio State University 1950; M.S. Ohio State University 1951; Ph.D. Ohio State University 1957, A Study of the Relationship of Merchandising Practices and Other Factors to the Price and Movement of Greenhouse Tomatoes in Retail Food Stores.

GENE MCMURTRY, B.S. University of Colorado 1954; M.S. Purdue University 1956; Ph.D. Purdue University 1957, Response of Farmers to Various Soil Bank Proposals—Selected Areas of Corn Belt.

FRANK MEISSNER, B.S. University of Copenhagen 1948; M.S. Iowa State College 1950; Ph.D. Cornell University, 1957, Production-Consumption Balance in the Rochester, New York, Milkshed.

JOHN DARRELL MILLER, B.A. Jamestown College 1948; M.S. University of Minnesota 1949; Ph.D. University of Missouri 1957, Some Economic Factors and Their Effect on the Poultry Industry of Missouri.

MARY BETH MINDEN, B.S. Oregon State College; Ph.D. Purdue University 1957, The Consumption and Implication for Consumer Education Programs.

DONALD S. MOORE, B.S. Oklahoma A & M College 1938; M.S. Oklahoma A & M College 1940; Ph.D. University of Minnesota 1957, A Study of the Effect of Individual Motivations and of Farm Business-Household Relationship Upon the Organization and Operation of 29 Southeastern Minnesota Farms, 1928-55.

LEO JOSEPH MORAN, B.S. University of Wisconsin 1954; M.S. University of Wisconsin 1955; Ph.D. University of Wisconsin 1957, Opportunities for Resource Development of Rural Wisconsin.

ERNEST JAMES MOSBAEK, B.S. Wisconsin State College 1952; M.S. Iowa State College 1955; Ph.D. Iowa State College 1957, Fitting a Static Supply and Demand Function for Labor.

YAIR MUNDLAK, B.S. University of California, Davis, 1953; Ph.D. University of California 1957, Analysis of Agricultural Production Forecast in Statistical Decision Theory Framework.

UDHIS NARKSWASDI, B.S. Kasetsart University 1944; L.B. University of Moral and Political Science 1951; M.S. University of Moral and Political Science 1953; Ph.D. Cornell University 1957, Cooperative Agricultural Credit in Thailand.

UMAR KHAN NIAZI, B.S. Punjab University, Pakistan, 1946; M.S. Punjab University 1948; Ph.D. Ohio State University 1957, Capital Regeneration of Agriculture in Pakistan.

ERIC C. OESTERLE, B.S. Cornell University 1947; M.S. Purdue University 1949; Ph.D. Purdue University 1957, A Financial Analysis of Independent Food Stores in Indiana.

HEUNG KEUN OH, B.S. Abilene College 1951; M.S. Colorado A & M College 1953; Ph.D. Ohio State University 1957, An Analysis of Factors Influencing Soft Red Winter Wheat Production.

GOGULA PARTHASARSTHY, B.A. Andhra University 1946; M.A. Madras University 1949; Ph.D. University of Wisconsin 1957, Underemployment and the Indian Agriculturist.

HORACE L. PUTERBAUGH, B.S. Purdue University; M.S. Purdue University; Ph.D. Purdue University 1957, Enterprise Selection by Linear Programming Analysis of Livestock Marketing System in Indiana.

HOWARD F. ROBINSON, B.S. A & T College of North Carolina 1948; M.S. University of Illinois 1949; Ph.D. Ohio State University 1957, History and Evaluation of Futures Trading in Potatoes, 1930-56.

RAYMOND W. ROBINSON, B.S. Oklahoma A & M College 1947; M.S. Oklahoma A & M College 1949; Ph.D. University of Wisconsin 1957, Costs and Efficiency of Wholesale Milk Distribution in Milwaukee with Particular Reference to Problems of Wholesale Pricing.

JAMES ROBERT ROUSH, B.S. University of Illinois 1950; M.S. University of Illinois 1953; Ph.D. University of Illinois 1957, An Analysis of Egg Price Reports Originating in Important North Central Region Markets.

J. T. SCOTT, B.A. Louisiana Polytechnic Institute 1949; M.B.A. University of Arkansas 1952; Ph.D. Iowa State College 1957, Application of Linear Programming for Profit Maximization in the Feed Firm.

RAYMOND E. SELTZER, B.S. University of Illinois 1940; M.S. Kansas State College of Agriculture and Applied Arts 1942; Ph.D. University of California 1957, The Competitive Position of the Los Angeles Cattle Market.

ADNAN SHUMAN, License in Law University of Syria 1949; Ph.D. Ohio State University 1957, The Cooperative Movement in Selected Countries in Europe and in the Arab States.

CECIL N. SMITH, B.S. Virginia Polytechnic Institute 1941; M.A. University of Virginia 1947; Ph.D. University of California 1957, An Economic Analysis of the Eastern Apple Industry.

THALERNG THAMRONG, B.S. University of Connecticut 1953; M.S. University of Wisconsin 1954; Ph.D. University of Wisconsin 1957, Selected Aspects of the Role of Primary Exports in the Economic Development of Southeast Asia.

NICHOLAS THUROCZY, B.S. McGill University 1952; Ph.D. University of California 1957, Economic Analysis of Multiple Pricing Plans for U.S. Barley.

JONATHAN STARBUCK TOBEY, B.A. Brown University 1950; B.S. University of Rhode Island 1953; M.S. Cornell University 1954; Ph.D. Cornell University 1957, Seasonal Returns from Marketing Eggs in Central New York, 1955-56.

GEORGE A. STEVENS, B.S. Virginia Polytechnic Institute 1941; Ph.D. University of Maryland 1957, Extent and Nature of Bruising of Maryland Peaches from the Orchard to the Retail Store.

WESLEY BURTON SUNDQUIST, B.S. North Dakota State College 1952; M.S. University of Kentucky 1954; Ph.D. Michigan State University of 1957, An Economic Analysis of Some Controlled Fertilizer Experiments in Michigan.

SRIDHAR TRIPATHY, B.S. Beneras Hindu University 1952; M.S. Beneras Hindu University 1954; Ph.D. Cornell University 1957, Village Governments in India.

ARTHUR JOSEPH WALRATH, B.S. University of Connecticut 1936; M.A. University of Wisconsin 1940; Ph.D. University of Wisconsin 1957, Impacts of the Expanding Urban-Rural Economy in Southeastern Wisconsin.

CHARLES A. WILMOT, B.S. University of Vermont 1949; M.S. Purdue University 1956; Ph.D. Purdue University 1957, Retailer Attitudes Toward Wholesaler-Retailer Integration and Possibilities of Increasing Retail Efficiency Through Management Assistance.

GARLAND P. WOOD, B.S. University of Wisconsin 1951; M.S. University of Wisconsin 1953; Ph.D. University of Wisconsin 1957, An Economic Analysis of Range Reseeding in Northern Nevada.

JOHN WRIGHT WYSONG, B.S. Cornell University 1953; M.S. University of Illinois 1954; Ph.D. Cornell University 1957, An Economic Analysis of Methods and Costs of Silage Storage on New York Dairy Farms, 1954-55.

TENTATIVE PROGRAM

AMERICAN FARM ECONOMIC ASSOCIATION

AND THE

CANADIAN AGRICULTURAL ECONOMICS SOCIETY

WINNIPEG, CANADA

AUGUST 19-22, 1958

Program Schedule

TUESDAY, AUGUST 19

9:00	A.M.	Executive Committee Meeting
2:00	P.M.	Registration
7:00	P.M.	Meeting of Student Officers and Student Section Committee
8:00	P.M.	Reception
		Program (9:00-10:00)

WEDNESDAY, AUGUST 20

8:00	A.M.	Registration
8:30- 9:50	A.M.	Opening Session
10:00-12:15	P.M.	General Session
12:30	P.M.	Lunch
1:30- 3:45	P.M.	Sectional Meetings
1:30- 3:45	P.M.	Presentation of Graduate Student Papers
4:00- 5:15	P.M.	Student Debates, first round
		Ad Hoc Sessions
6:00	P.M.	Outdoor Dinner
8:00	P.M.	Entertainment

THURSDAY, AUGUST 21

8:30	A.M.	A.F.E.A. and C.A.E.S. Business Meetings
		Student Debates, second round
10:00-12:15	P.M.	General Session
12:20	P.M.	Group Photograph
12:30	P.M.	Lunch
1:30- 3:35	P.M.	Sectional Meetings
1:30- 3:35	P.M.	Student Public Speaking Contest
3:50- 5:55	P.M.	Sectional Meetings
		Student Debates, third round
6:30	P.M.	Dinner
7:45- 9:45	P.M.	Recognition and Awards Program

FRIDAY, AUGUST 22

8:30	A.M.	Student Section Business Meeting
8:30-10:15	A.M.	Sectional Meetings
10:30-12:15	P.M.	Sectional Meetings
12:30	P.M.	Lunch—General Session
2:30	P.M.	Executive Committee Meeting

MEETING THE CHALLENGE OF SCIENCE IN AGRICULTURE

Wednesday, August 20, 1958

OPENING SESSION—8:30-9:50 A.M.

Chairman: Harry C. Trelogan, Agricultural Marketing Service, USDA
Welcome: H. H. Saunderson, President, and
Announcements: J. R. Weir, Dean, University of Manitoba
Address: The Impact of Science on Agriculture, Raymond G. Bressler (President-elect, A.F.E.A.), University of California

GENERAL SESSION—10:00 A.M.-12:15 P.M.

UNDERLYING CAUSES OF CHANGE FROM NATURAL SCIENCES
Chairman:
The Physical Sciences
Speaker:
Biological Sciences
Speaker: T. C. Byerly, Agricultural Research Service, USDA
Discussion: Implications to Farm Policy
Harold G. Halcrow, University of Illinois
Implications to Farm Management
Earl O. Heady, Iowa State College
Implications to Agricultural Marketing
Ben C. French, Michigan State University

SECTION MEETINGS—1:30-3:45 P.M.

SECTION I. SCIENTIFIC PROGRESS AND PROBLEMS OF AGRICULTURAL ADJUSTMENT
Chairman: Ben T. Lanham, Alabama Polytechnic Institute
Technological Change, Food Needs, and Aggregate Resource Adjustment
Speaker: Glen T. Barton, Agricultural Research Service, USDA
Discussant: W. E. Haviland, Macdonald College, McGill University
Technological Change and Farm Manpower Adjustment
Speaker: Walter B. Garver, U. S. Chamber of Commerce
Discussant: George V. Haythorne, Canada Department of Agriculture, Ottawa
Scientific Progress, Land Requirements, and Land-Use Adjustments
Speaker: Howard W. Ottoson, University of Nebraska
Discussant: John F. Timmons, Iowa State College

SECTION II. RESPONSE OF PRODUCTION TO PRICES
Chairman: J. P. Cavin, Agricultural Marketing Service, USDA
The Response of Wheat Production to Prices
Speaker: John A. Schnittker, Kansas State College
Discussant: Clay Gilson, University of Manitoba
Response of Dairy Production to Prices
Speaker: Harlow W. Halvorson, University of Wisconsin
Discussant: John R. King, Doane Agricultural Service, Inc.
Response of the Farm Production Unit as a Whole to Prices
Speaker: J. R. Tompkin, Ohio State University
Discussant: James S. Plaxico, Oklahoma State University

SECTION III. FINANCING A DYNAMIC AGRICULTURE

Chairman: Fred L. Garlock, Agricultural Research Service, USDA
Intermediate-Term Credit in Agriculture
Speaker: S. A. Morrow, Federal Intermediate Credit Bank of St. Louis
Discussant: Nicholas A. Jamba, National Bank and Trust Company, Norwich, N.Y.
Effect of Urban and Industrial Development on Agricultural Finance
Speaker: Howard G. Diesslin, The Farm Foundation, Chicago
Discussant:
Federal Financing of Rural Utilities
Speaker: Everett C. Weitzell, Rural Electrification Administration, USDA
Discussant: John L. Fischer, University of Nevada

SECTION IV. FARM SUPPLY MARKETS

Chairman: B. N. Arneson, Department of Cooperation, Saskatchewan
The Changing Structure of Markets for Farm Machinery
Speaker: W. G. Phillips, Assumption University of Windsor
Discussant: Martin A. Abrahamsen, Farmer Cooperative Service, USDA
The Changing Structure of Markets for Fertilizer
Speaker: E. L. Baum, Tennessee Valley Authority
Discussant: Calvin R. Berry, University of Arkansas
The Changing Structure of Markets for Commercial Feeds
Speaker: V. John Brensike, Agricultural Marketing Service, USDA
Discussant: Robert W. Schoeff, Central Soya Company, Inc., Fort Wayne, Indiana

SECTION V. ADAPTING DATA TO NEW CONDITIONS

Chairman: F. V. Waugh, Agricultural Marketing Service, USDA
Agricultural Statistics in a Changing Agriculture
Speaker: O. V. Wells, Agricultural Marketing Service, USDA
Discussant: Peyton Stapp, Bureau of the Budget
Impact of Electronic Computing on Farm Economic Research
Speaker: Vincent I. West, University of Illinois
Discussant: G. G. Judge, Oklahoma State University
Use of Experimental Design in Marketing Research
Speaker: M. E. Brunk, Cornell University
Discussant: J. R. Bowring, University of New Hampshire

SECTION VI. WORLD AGRICULTURAL DEVELOPMENT

Chairman: John F. Booth, Canada Department of Agriculture, Ottawa
Technological Developments in World Agricultural Production
Speaker: Wilhelm Anderson, Foreign Agricultural Service, USDA
Discussant: Harold Vogel, Food and Agriculture Organization of the United Nations
Surplus Disposal—Accomplishments and Objectives
Speaker: John H. Davis, Harvard University
Discussant: A. H. Turner, Canada Department of Agriculture, Ottawa
Tropical Agriculture—Competitive or Complementary?
Speaker: Quentin M. West, Foreign Agricultural Service, USDA
Discussant: G. W. Hedlund, Cornell University

SECTION VII. SCIENTIFIC PROGRESS AND THE AGRICULTURE OF THE PLAINS AND PRAIRIE PROVINCES

Chairman:
Effect of Scientific Progress on Size and Efficiency of Farms
Speaker: Leonard F. Miller, Oklahoma State University
Discussant: Meyer Brownstone, Saskatchewan Economic Council
New Techniques and Farming Systems to Reduce Risk
Speaker:
Discussant:
Institutional Adaptations to the Environment
Speaker: Stanley Voelker, Agricultural Research Service, USDA, Fargo, North Dakota
Discussant: H. R. Stucky, New Mexico A and M College

SECTION VIII. GRADUATE STUDENT PAPERS
Chairman: A. Gordon Ball, Iowa State College

Three papers submitted by graduate students will be selected for special recognition at this session. Each of these papers will be presented and discussed.
Discussants: Irving Dubov, University of Tennessee
L. T. Smythe, South Dakota State College

Thursday, August 21, 1958

GENERAL SESSION—10:00 A.M.-12:15 P.M.

CONTRIBUTIONS OF SOCIAL SCIENCES TO CHANGE AND ADJUSTMENT
Chairman: George H. Aull, Clemson Agricultural College
Economic Theory
Speaker: O. H. Brownlee, University of Minnesota
Means for Maintaining Economic Stability
Speaker: Yale Brozen, University of Chicago
Discussion: Implications to Farm Policy
David MacFarlane, Macdonald College, McGill University
Implications to Farm Management
Roy E. Huffman, Montana State College
Implications to Agricultural Marketing

SECTION MEETINGS—1:30-3:35 P.M.

SECTION I. PROSPECTS IN FOOD, NUTRITION, AND CONSUMER BEHAVIOR
Chairman: Marguerite C. Burk, Agricultural Marketing Service, USDA
Developments in Human Nutrition Research
Speaker: L. B. Pett, Department of National Health and Welfare, Ottawa
Discussant: Rosalind C. Lifquist, Agricultural Marketing Service, USDA
Contributions of Current Research in Food Technology
Speaker: E. M. Mrak, University of California, Davis
Discussant: Lee Kolmer, Iowa State College
What We Do and Do Not Know about Food Habits of American Families
Speaker: Margaret G. Reid, University of Chicago
Discussant: A. C. Hoffman, Kraft Foods Company, Chicago

SECTION II. MODIFYING MARKET ORGANIZATION AND PRACTICES

Chairman: R. S. Elliot, Winnipeg Grain Exchange
Altering Marketing Concepts to Modern Conditions
Speaker: Paul E. Nelson, Jr., Denison University
Discussant: G. W. Ladd, Iowa State College
Adapting Market Organization to Changing Requirements
Speaker: D. B. DeLoach, University of California, Los Angeles
Discussant: N. T. Pritchard, Agricultural Marketing Service, USDA
Developing Buying Policies in Decentralized Assembly Markets
Speaker: Robert L. Clodius, University of Wisconsin
Discussant: Kenneth D. Naden, National Association of Food Chains, Washington, D.C.

SECTION III. IMPACT OF TECHNOLOGY ON PRICES AND INCOMES IN AGRICULTURE

Chairman: Nathan M. Koffsky, Agricultural Marketing Service, USDA
Productivity Trends in Agriculture and Industry
Speaker: J. W. Kendrick, George Washington University and Bureau of the Budget
Discussant: L. Jay Atkinson, U. S. Department of Commerce
Changing Relationships Between Agriculture and the National Economy
Speaker: William Cromarty, Michigan State University
Discussant: Phillip T. Allen, Federal Reserve Board, Washington, D.C.
Implications of Changing Technology for Agricultural Prices and Incomes
Speaker: M. A. MacGregor, Ontario Agricultural College
Discussant: George Brandow, Pennsylvania State University

SECTION IV. NONAGRICULTURAL USES OF RURAL LAND AND WATER

Chairman: Gladwin E. Young, Soil Conservation Service, USDA
Extent and Significance of Nonagricultural Uses
Speaker: Hugh H. Wooten and Hugh A. Johnson, Agricultural Research Service, USDA
Discussant: Philip M. Raup, University of Minnesota
Recreational Uses of Rural Lands and Water
Speaker: Charles W. Loomer, University of Wisconsin
Discussant: W. David Hopper, Ontario Agricultural College
Minimizing Adverse Impacts of Major Land Use Shifts
Speaker: Raleigh Barlowe, Michigan State University
Discussant: John Muehlbeier, George Plains Agricultural Council, Lincoln, Nebraska

SECTION V. EFFECTS OF SCIENTIFIC PROGRESS ON THE FAMILY FARM

Chairman:
Scientific Progress and the Future of Family Farming
Speaker: John M. Brewster, Agricultural Research Service, USDA
Discussant: Sol Sinclair, University of Manitoba
Increased Capital Requirements and the Problem of Getting Started in Farming
Speaker: Hadley Van Vliet, University of Saskatchewan

Discussant: Truman R. Nodland, University of Minnesota
Corporate Organization of Family Farms
Speaker: Norman G. P. Krausz, University of Illinois
Discussant:

SECTION VI. VERTICAL INTEGRATION OF AGRICULTURE–I

Chairman:
Dynamics of the Integration of Agricultural Production and Marketing
Speaker: H. K. Leckie, Meat Packers Council of Canada, Toronto
Discussant:
Credit Implications of Integration in Agriculture
Speaker: Russell C. Engberg, Farm Credit Administration
Discussant: Ivy W. Duggan, Trust Company of Georgia, Atlanta
Tenure Innovations and Tenure Problems Associated with Vertical Integration
Speaker: Raymond J. Penn, University of Wisconsin
Discussant: Marshall Harris, University of Iowa

SECTION MEETINGS–3:50-5:55 P.M.

SECTION I. ROLE OF TECHNOLOGY IN ALTERING VALUE JUDGMENTS AND SOCIAL STRUCTURE

Chairman: Lowry Nelson, University of Minnesota
Impact of Technological Advance on Our Value System
Speaker: M. E. John, Pennsylvania State University
Discussant: John H. Southern, Texas A and M College
Implications of Declining Farm Population for Power Position of Farmers
Speaker: Charles M. Hardin, University of Chicago
Discussant: Willard Cochrane, University of Minnesota
Influence of Social Security for Farmers on Population Adjustment
Speaker: J. C. Ellickson, Agricultural Research Service, USDA
Discussant: Robert G. F. Spitze, University of Tennessee

SECTION II. FARMERS' DECISIONS ON NEW PRACTICES

Chairman:
New Knowledge of Decision-Making Processes
Speaker: Glenn Johnson, Michigan State University
Discussant:
Farmer Decisions in the Use of Fertilizer
Speaker: M. S. Williams, National Plant Food Institute Washington, D. C.
Discussant: E. H. M. Hartmans, University of Minnesota
Using Process Analysis to Improve Farm Organization
Speaker: Irving F. Fellows, University of Connecticut
Discussant: Roy Van Arsdall, Agricultural Research Service, USDA, Urbana, Illinois

SECTION III. RIVER BASIN DEVELOPMENT

Chairman: R. R. Renne, President, Montana State College
Planning and Evaluation
Speaker: John Krutilla, Resources for the Future, Washington, D. C.
Discussant: Albert R. Johnson, U. S. Department of the Interior

Sharing Financial Responsibility
Speaker: Mark M. Regan, Agricultural Research Service, USDA
Discussant: George S. Tolley, North Carolina State College
Organization for Resource Management
Speaker: Kristjan Kristjanson, Ministry of Northern Affairs and National Resources, Ottawa
Discussant: Stephen C. Smith, University of California

SECTION IV. TRADING PROBLEMS IN INTERNATIONAL MARKETS

Chairman: Robert C. Tetro, Foreign Agricultural Service, USDA
Competition in International Trade
Speaker: S. Claude Hudson, Department of Trade and Commerce, Ottawa
Developing Institutions to Govern Trade
Speaker: Willis C. Armstrong, U. S. Embassy, Ottawa
Multiple Price Schemes at Home and Abroad
Speaker: Harry R. Woltman, University of California
Discussants: Geoffrey S. Shepherd, Iowa State College
Lawrence L. Boger, Michigan State University

SECTION V. MEETING CURRENT AND AREA DATA REQUIREMENTS IN A CHANGING AGRICULTURE

Chairman: Dorris D. Brown, Mutual Federation of Independent Cooperatives, Syracuse, New York
Current and Area Data Progress and Future Needs in Canada
Speaker: C. W. Parker, Allan Holmes, Dominion Bureau of Statistics, Ottawa
Discussant: S. R. Newell, Agricultural Marketing Service, USDA
Current and Area Data Progress and Future Needs in the United States
Speaker: J. Carroll Bottum, Purdue University, and
Joe Ackerman, Farm Foundation, Chicago
Discussant: Roy A. Bodin, Minnesota State Department of Agriculture
State and Local Data that Census Expects to Supply from 1959 Census of Agriculture
Speaker: Ray Hurley, Division of Agriculture, U. S. Census Bureau
Discussant: J. L. Forsythe, Dominion Bureau of Statistics, Ottawa

SECTION VI. TECHNICAL PROGRESS AND VERTICAL INTEGRATION OF AGRICULTURE, II

Chairman: J. W. Fanning, University of Georgia, Athens
Alternative Ways of Coordinating Production and Marketing
Speaker: Ewell P. Roy, Louisiana State University
Discussant: Gordon W. Sprague, Land O'Lakes Creameries, Minneapolis
Decision-Making in Integrated Production and Marketing Systems
Speaker: R. L. Kohls, Purdue University
Discussant: W. E. Folz, University of Idaho
Impacts of Vertical Integration on Output, Price, and Industry Structure
Speaker: C. E. Bishop, North Carolina State College
Discussant: Stanley K. Seaver, University of Connecticut

Friday, August 22, 1958

CONTRIBUTED PAPERS

Members are invited to present a paper on a subject of their choice. Author of the paper should choose the section for his presentation from those listed below and submit a copy of the paper to the chairman of the section not later than August 1.

Papers should not exceed 1,500 words. Maximum time of presentation is 10 minutes.

The ribbon copy of the final draft should be turned in to the chairman at the end of session. Not more than one paper will be selected from each session for publication in the *Journal.*

SECTION MEETINGS—8:30-10:15 A.M.

Section I. Farm Management Research
Chairman: John H. Sitterly, Ohio State University
Section II. Marketing Research
Chairman: H. G. Hamilton, University of Florida
Section III. Agricultural Policy Research
Chairman: G. Burton Wood, Oregon State College
Section IV. Research with Farmer Cooperatives
Chairman: Joseph G. Knapp, Farmer Cooperative Service, USDA
Section V. Agricultural Finance
Chairman: Aaron G. Nelson, University of Arizona
Section VI. Consumption Economics
Chairman: Aubrey J. Brown, University of Kentucky
Section VII. Contract Farming and Integration
Chairman: George Max Beal, University of Maryland
Section VIII. Undergraduate Teaching in Agricultural Economics
Chairman: Elmer R. Kiehl, University of Missouri

SECTION MEETINGS—10:30 A.M.-12:15 P.M.

Section IX. Research Methods
Chairman: Charles E. French, Purdue University
Section X. Farm Management Extension
Chairman: Glen C. Pulver, University of Wisconsin
Section XI. Marketing Extension
Chairman: Clifton B. Cox, Purdue University
Section XII. Extension in Public Affairs
Chairman: Luther J. Pickrel, University of Minnesota
Section XIII. Agricultural Prices
Chairman: Fred R. Taylor, North Dakota Agricultural College
Section XIV. Land and Water Resource Development
Chairman: Owen L. Brough, Jr., State College of Washington
Section XV. Graduate Teaching in Agricultural Economics
Chairman: H. Brooks James, North Carolina State College

GENERAL SESSION—12:30 P.M. (Luncheon)
Chairman: Harry C. Trelogan, Agricultural Marketing Service, USDA
Address:

JOURNAL OF THE AMERICAN STATISTICAL ASSOCIATION

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ARTICLES

AMERICAN ECONOMIC REVIEW

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Communications

The AMERICAN ECONOMIC REVIEW, a quarterly, is the official publication of the American Economic Association and is sent to all members. The annual dues are six dollars. Address editorial communications to Dr. Bernard F. Haley, Editor, AMERICAN ECONOMIC REVIEW, Stanford University, Room 220, Stanford, California; for information concerning other publications and activities of the Association, communicate with the Secretary-Treasurer, Dr. James Washington Bell, American Economic Association, Northwestern University, Evanston, Illinois. Send for information booklet.

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